

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE J		PAGE OF PAGES 1 5	
2. AMENDMENT/MODIFICATION NO. 0007		3. EFFECTIVE DATE 29-May-2003		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO.(If applicable) 0250570	
6. ISSUED BY USA ENGINEER DISTRICT, SEATTLE ATTN: CENWS-CT P.O. BOX 3755 SEATTLE WA 98124-3755		CODE DACA67		7. ADMINISTERED BY (If other than item 6) See Item 6		CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)				X		9A. AMENDMENT OF SOLICITATION NO. DACA67-03-R-0210	
				X		9B. DATED (SEE ITEM 11) 22-Apr-2003	
						10A. MOD. OF CONTRACT/ORDER NO.	
						10B. DATED (SEE ITEM 13)	
CODE		FACILITY CODE					
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS							
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> is not extended. Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning <u>0</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.							
12. ACCOUNTING AND APPROPRIATION DATA (If required)							
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.							
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.							
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).							
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:							
D. OTHER (Specify type of modification and authority)							
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.							
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) BATTLE SIMULATION CENTER, FORT LEWIS WA - SEE CONTINUATION							
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.							
15A. NAME AND TITLE OF SIGNER (Type or print)				16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)			
				TEL: EMAIL:			
15B. CONTRACTOR/OFFEROR		15C. DATE SIGNED		16B. UNITED STATES OF AMERICA		16C. DATE SIGNED	
_____ (Signature of person authorized to sign)				BY _____ (Signature of Contracting Officer)		29-May-2003	

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

A. This amendment provides for the following revisions to the solicitation:

1. SPECIFICATIONS CONTAINING MODIFICATIONS

<u>Section</u>	<u>Title</u>
01270	PAYMENT Paragraph 1.2.10, Modified Description of Option Item to include extension of concrete pad and CMU screen wall.
02300	EARTHWORK Revisions to paragraph 1.7, Utilization of Excavated Materials Revisions to paragraph 3.3, Selection of Borrowed Materials
02924	REINFORCED HARDENED DRIVEABLE TURF Table 2.1.1 Note added regarding seed mix Reference to table number revised.
05120	STRUCTURAL STEEL Paragraph 1.5, Delete requirement for certified steel erector.
05500	MISC. METALS Deleted Paragraph 2.2 – Corner Guards and Shields, Reference section 10260 for specified items Deleted Paragraph 2.13 – Fire Extinguisher Cabinets
06200	FINISH CARPENTRY Deleted Paragraph 2.1.6 – Epoxy -Aggregate Panels
07214	BOARD AND BLOCK INSULATION Paragraph 3.3.3, changed distance from 6 feet to 2 feet.
07530	ELASTOMERIC ROOFING (EPDM) Paragraph 2.7, revised concrete paver thickness
10522	FIRE EXTINGUISHER CABINETS Delete paragraph 1.3 Delete paragraph 2.5
15895	AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM Revisions to paragraph 3.1.6, Exposed Ductwork
16710	PREMISES DISTRIBUTION SYSTEM Minor revisions to part identifications for Cruz Boxes and patch panel.

DRAWING REVISIONS BY NOTATION**Irrigation Plan, Sheet 44, Plate L-101**

(a) Delete “and in Section 02811, “Landscape Irrigation” from the last line of the option item description

Planting Plan, Sheet 45, Plate L-102

(a) Delete “and in Section 02930, “Exterior Plants” from the last line of the option item description

Roof Framing Plan – NW Quadrant, Sheet 57, Plate S-106

Add Plan note “8” as follows:

- (a) Provide elevated structural platform for suspended electrical transformers located just north of Grid 5 near Grid C (typ of 3 places total) as follows:
- A. Platform system shall be able to support self weight plus 1000 lbs equipment dead load for each electrical transformer unit (TXPCP4, TXPCP5, and TXNA units; 3 total).
 - B. Platform shall consist of 36" x 36" steel frame system with 3/16-inch steel plate cover welded to each steel frame support member. Unless otherwise noted, locate bottom of platform 2'-0" above finish ceiling; coord with arch, mech, and elec.
 - C. Platforms shall be located as required in plan view (near location shown on electrical plans - see Drawing E-107) to align with roof joist panel point layout, coord with joist manufacturer.
 - D. Steel frame system shall consist of C4x5.4 perimeter support members and (2) C4x5.4 interior support members located directly under each transformer equipment support; channel support members shall have welded (3/16-inch fillet all-around) end connections.
 - E. Platform shall be suspended from roof joist system using (4) 3/8-inch diameter threaded rods (typ 1 per corner; 4 per unit) with double nut connection at top and bottom connections. Threaded rods shall be connected to channel platform support frame at bottom.
 - F. Threaded rod top connection shall be connected to Unistrut P1000 structural support system (or approved equal) supported on roof joist bottom chords and located adjacent to joist bottom chord panel points where possible. Provide joist stiffeners as reqd, see Detail 5/S-705.
 - G. Provide diagonal lateral bracing support of suspended platforms along each edge of platform and in both directions (total of 8 braces per platform). Bracing shall consist of one or more of the following: (1) hanger wire per Spec Section 09510 ACOUSTICAL CEILINGS, aircraft cable (1/8" dia minimum) with turnbuckle system, Unistrut support system, or other approved system. Each lateral brace support shall be capable of supporting a minimum of 200 lbs tension force. Lateral braces shall be connected to roof joist top chord members where possible. Provide additional joist cross brace bridging at locations where lateral brace system connects to joist bottom chord members.
 - H. Transformer equipment shall be connected to platform steel channel with 5/8-inch diameter bolts (minimum one per corner); coord size and location with equipment manufacturer.
 - I. Contractor shall be responsible to coordinate final electrical transformer equipment support dead load reactions and locations with roof joist manufacturer prior to design and fabrication of roof joists.

Exterior Details, Sheet 145, Plate A-505

- (a) Detail 10/A-506. Add notes pointing to infill wall at WF rail. "20 ga, 2 1/2 inch studs at 16" o.c., (1) layer 5/8" glass-matt faced gypsum panel"

Exterior Details, Sheet 145, Plate A-506

- (a) Detail 3/A-506, Delete note that reads "2 1/2" [64] Metal Stud Framing".

Comm Connection at Building 2003, Sheet 168a, Plate A-704

- (a) Add a general note that all work on this sheet is part of Option Item No. 0013.

Furniture Floor Plan Northwest Quadrant, Sheet 169, Plate I-102

- (b) Revise General Note 2 to read as follows:
"See Specification Section 12705 for typical systems furniture layouts and components list"

Furniture Floor Plan Northeast Quadrant, Sheet 170, Plate I-103

- (a) Revise General Note 2 to read as follows:
"See Specification Section 12705 for typical systems furniture layouts and components list"

Furniture Floor Plan Southeast Quadrant, Sheet 171, Plate I-104

- (a) Revise General Note 2 to read as follows:
"See Specification Section 12705 for typical systems furniture layouts and components list"

Furniture Floor Plan Southwest Quadrant, Sheet 172, Plate I-105

- (a) Revise General Note 2 to read as follows:
"See Specification Section 12705 for typical systems furniture layouts and components list"

HVAC Plan – SE Quadrant, Sheet 181, Plate M-104

On Sheet M-04 at approximately grid 9.3/E.9 Key Note #6 points to a 18" diameter duct. Key note #6 does not apply to this particular piece of ductwork. Delete this note reference to the 18" diameter duct.

Telecommunications OSP Copper Backbone Cabling Diagram, Sheet 274G, Plate T-206

- (a) Copper cable routed between V#12 and V#16 shall be changed to PE-89 300 pair from 700 pair as currently shown on drawing.

Details, Sheet 306, Plate T-701

- (a) Add general note that states; "MSE and FM outlets use Category 6 cable. FM outlets have one set of binding posts and MSE outlets have two sets of binding posts required. Each FM and MSE outlet gets (1) Cat 6 cable pulled to it. A typical Cruz box will require (6) Cat 6 cables for the FM and MSE outlets since there are (3) FM and (3) MSE outlets. In the Commo Rooms these Cat 6 cables will terminate on the 66 wall field for MSE/FM. Coordinate exact pair termination with owner."

Electrical General Notes and Luminaire Schedule, Sheet 215, Plate E-001

- (a) Clarification: Fixture type S4 referenced on Luminaire Schedule shall be fixture type B4.
(b) Clarification: Fixture type C2 is not used on this project.

Lighting Plan Northwest Quadrant, Sheet 219, Plate E-102

- (a) In Note 8, replace "Type D2" with "Type D6".
(b) Clarification: All Type D6 fixtures shall be a dimming type.

Electrical Room and Substation Plan and Details, Sheet 231, Plate E-400

- (a) Detail 3/E-400, Electrical Room and Substation Plan - TXPCP9 should be located in the transformer rack, not TXPCP4, as this was mislabeled.
(b) Locations for TXPCP4 and TXPCP5 are shown on Drawing E-107.
(c) Mounting for TXPCP4, TXPCP5, and TXNA on platforms from the roof structure is addressed in this Amendment 0007, in association with the structural drawings / package.

Foundation/Flr Plan NE Quadrant, Sheet 54, Plate S-103

- (a) Delete footing designation "F6" located near Grid J-4.

Section "A", Sheet 66, Plate S-301

- (a) Revise footing thickness shown in Section A from 1'-0" [305] to 1'-3" [381] to match thickness shown in Concrete Footing Schedule on Plate S-300.

B. The revised attached pages supersede pages of the same number and should be inserted in numerical sequence. All changes are generally identified, for your convenience, either by strikeout for deletions, and underlining of text for additions or single

dark line in the margin. All portions of the revised or new pages shall apply to this contract whether or not changes have been indicated.

C. The time and date for receipt of proposals remain the same at 2:00 p.m., local time, 02 June 2003.

D. Offerors must acknowledge receipt of this amendment by number and date on the Standard Form 1442 BACK (page 00010-2) in Block 19 or by telegram.

Enclosures:

Rev. SF1442 Front and Back

Rev. 0800 DRAWING REVISIONS BY NOTATION

Rev. 01270 PAYMENT

Rev. 02300 EARTHWORK

Rev. 02924 REINFORCED HARDENED DRIVEABLE TURF

Rev. 05120 STRUCTURAL STEEL

Rev. 05500 MISC. METALS

Rev. 06200 FINISH CARPENTRY

Rev. 07214 BOARD AND BLOCK INSULATION


Rev. 07530 ELASTOMERIC ROOFING (EPDM)

Rev. 10522 FIRE EXTINGUISHER CABINETS

Rev. 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

Rev. 16710 PREMISES DISTRIBUTION SYSTEM

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SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)		1. SOLICITATION NUMBER DACA67-03-R-0210	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (IFB) <input checked="" type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED 22 April 2003	PAGE OF PAGES 1
IMPORTANT - The "offer" section on the reverse must be fully completed by the offeror.					
4. CONTRACT NUMBER		5. REQUISITION/PURCHASE REQUEST NUMBER W68MD9-3027-6329		6. PROJECT NUMBER	
7. ISSUED BY Seattle District, Corps of Engineers ATTN: CENWS-CT-CB-MU PO Box 3755 Seattle, WA 98124-3755		CODE W68MD9	8. ADDRESS OFFER TO Seattle District, Corps of Engineers PO Box 3755 ATTN: CENWS-CT-CB-MU - Mitton Seattle, WA 98124-3755 HAND CARRY: Seattle District Corps of Engineers Contracting Division 4735 East Marginal Way South Seattle, WA 98134-2329		
9. FOR INFORMATION CALL 		A. NAME See Information Page inside Front Cover		B. TELEPHONE NUMBER (Include area code) (NO COLLECT CALLS) See Information Page inside Front Cover	

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying number, date):

Furnish all labor, materials and equipment and perform all work for Battle Simulation Center, Fort Lewis, WA in accordance with the attached Contract Clauses, Special Clauses, Technical Specifications and Drawings.

NOTE: Award will be made pursuant to the Small Business Competitive Demonstration Program

11. The Contractor shall begin performance within 10 calendar days and complete it within _____ calendar days after receiving

☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. (See Paragraph SC-1, 00800 .)

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE PAYMENT BONDS?
(If "YES," indicate within how many calendar days after award in Item 12B.)

☒ YES ☐ NO

12B. CALENDAR DAYS

10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 0 copies to perform the work required are due at the place specified in Item 8 by 2:00 p.m. (hour) local time 02 June 2003 (date). If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☒ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 90 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER (Must be fully completed by offeror)

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)

15. TELEPHONE NUMBER (Include area code)

Fax No.:

16. REMITTANCE ADDRESS (Include only if different than Item 14)

Tax ID No:

DUNS No:

eMail:

CODE

FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. (Insert any number equal or greater than the minimum requirement stated in 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)

AMOUNTS



See Pages 00010-5 thru 00010-8

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGEMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

AMENDMENT NO.

DATE

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)

20B. SIGNATURE

20C. OFFER DATE

AWARD (To be completed by Government)

21. ITEMS ACCEPTED

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN
(4 copies unless otherwise specified)

ITEM

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

☐ 10 U.S.C. 2304(c) ()☐ 41 U.S.C. 253(c) ()

26. ADMINISTERED BY

CODE

27. PAYMENT WILL BE MADE BY

United States Army Corps of Engineers Seattle District
Northwest Area Office
PO Box 92146
Tillicum, WA 98492-0146

US Army Corps of Engineers Finance Center
CEFC-AO-P, 5722 Integrity Drive
Millington, TN 38054-5005

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return _____ copies to the issuing office.) Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.

☐ 29. AWARD. (Contractor is not required to sign this document.) Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN
(Type or print)

31A. NAME OF CONTRACTING OFFICER (Type or print)

30B. SIGNATURE

30C. DATE

31B. UNITED STATES OF AMERICA

31C. AWARD DATE

BY

TABLE OF CONTENTS

SPECIAL CLAUSES - CONSTRUCTION

<u>PARAGRAPH NO.</u>	<u>PARAGRAPH TITLE</u>
SC-1	COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK
SC-1.1	OPTION FOR INCREASED QUANTITY
SC-2	LIQUIDATED DAMAGES - CONSTRUCTION
SC-3	<u>DELETED</u> – TIME EXTENSIONS
SC-4	<u>DELETED</u> - VARIATIONS IN ESTIMATED QUANTITIES - SUBDIVIDED ITEMS
SC-5	INSURANCE - WORK ON A GOVERNMENT INSTALLATION
SC-6	<u>DELETED</u> – CONTINUING CONTRACTS
SC-7	PERFORMANCE OF WORK BY THE CONTRACTOR
SC-8	PHYSICAL DATA
SC-9	<u>DELETED</u> – QUANTITY SURVEYS
SC-10	LAYOUT OF WORK
SC-11	RESERVED
SC-12	<u>DELETED</u> – AIRFIELD SAFETY PRECAUTIONS
SC-13	<u>DELETED</u> – IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY
SC-14	EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE
SC-15	PAYMENT FOR MATERIALS DELIVERED OFF-SITE
SC-16	<u>DELETED</u> – ORDER OF PRECEDENCE
SC-17	<u>DELETED</u> – LIMITATION OF PAYMENT FOR DESIGN
SC-18	CONTRACT DRAWINGS AND SPECIFICATIONS
SC-19.	<u>DELETED</u> – TECHNICAL PROPOSAL - COPIES TO BE FURNISHED UPON AWARD
SC-20.	<u>DELETED</u> – COMPLIANCE CERTIFICATION
SC-21.	<u>DELETED</u> – VALUE ENGINEERING
SC-22.	EPA ENERGY STAR
SC-23	RECOVERED MATERIALS

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SECTION 00800

SPECIAL CLAUSES - CONSTRUCTION

SC-1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984) (FAR 52.211-10).

The Contractor will be required to (a) commence work under this Contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) to prosecute the work diligently, and (c) to complete the entire work ready for use no later than 570 calendar days after date of receipt by Contractor of notice to proceed. The time stated for completion shall include final cleanup of the premises.

SC-1.1 OPTION FOR INCREASED QUANTITY

a. The Government may increase the quantity of work awarded by exercising one or more of the Optional Bid Items 0007 through 0015 at any time, or not at all, but no later than 90 calendar days after receipt by Contractor of notice to proceed. Notice to proceed on work Item(s) added by exercise of the option(s) will be given upon execution of consent of surety.

b. The parties hereto further agree that any option herein shall be considered to have been exercised at the time the Government deposits written notification to the Contractor in the mails.

c. The time allowed for completion of any optional items awarded under this contract will be the same as that for the base item(s), and will be measured from the date of receipt of the notice to proceed for the base item(s).

SC-1.2 Exception to Completion Period(s): In case the Contracting Officer determines that completion of seeding, sodding, and planting, and establishment of same is not feasible within the completion period(s) stated above, the Contractor shall accomplish such work in the first planting period following the contract completion period and shall complete such work as specified, unless other planting periods are directed or approved by the Contracting Officer.

SC-2. LIQUIDATED DAMAGES - CONSTRUCTION (SEP 2000) (FAR 52.211-12)

(a) If the Contractor fails to complete the work within the time specified in the Contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of \$1,742.00 for each day of delay.

(b) If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

(c) If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

(d) Exception to Liquidated Damage: In case the Contracting Officer determines that completion of work stated above in paragraph Exception to Completion Period(s) is not feasible

during the completion period(s) stated in SC-1, such work will be exempted from liquidated damages.

SC-3 AND SC-4 DELETED.

SC-5. INSURANCE - WORK ON A GOVERNMENT INSTALLATION (JAN 1997) (FAR 52.228-5)

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance period of this Contract at least the kinds and minimum amounts of insurance required in the Insurance Liability Schedule or elsewhere in the Contract.

(b) Before commencing work under this Contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective:

(1) for such period as the laws of the State in which this Contract is to be performed prescribe; or

(2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this Contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the Contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(d) Insurance Liability Schedule (FAR 28.307-2)

(1) Workers' compensation and employer's liability. Contractors are required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when Contract operations are so commingled with a Contractor's commercial operation that it would not be practical to require this coverage. Employer's liability coverage of at least \$100,000 shall be required, except in states with exclusive or monopolistic funds that do not permit workers' compensation to be written by private carriers.

(2) General Liability.

(a) The Contracting Officer shall require bodily injury liability insurance coverage written on the comprehensive form of policy of at least \$500,000 per occurrence.

(b) Property damage liability insurance shall be required only in special circumstances as determined by the agency.

(3) Automobile liability. The Contracting Officer shall require automobile liability insurance written on the comprehensive form of policy. The policy shall provide for bodily injury

and property damage liability covering the operation of all automobiles used in connection with performing the Contract. Policies covering automobiles operated in the United States shall provide coverage of at least \$200,000 per person and \$500,000 per occurrence for bodily injury and \$20,000 per occurrence for property damage. The amount of liability coverage on other policies shall be commensurate with any legal requirements of the locality and sufficient to meet normal and customary claims.

(4) Aircraft public and passenger liability. When aircraft are used in connection with performing the Contract, the Contracting Officer shall require aircraft public and passenger liability insurance. Coverage shall be at least \$200,000 per person and \$500,000 per occurrence for bodily injury, other than passenger liability, and \$200,000 per occurrence for property damage. Coverage for passenger liability bodily injury shall be at least \$200,000 multiplied by the number of seats or passengers, whichever is greater.

(5) Environmental Liability. If this contract includes the transport, treatment, storage, or disposal of hazardous material waste the following coverage is required.

The Contractor shall ensure the transporter and disposal facility have liability insurance in effect for claims arising out of the death or bodily injury and property damage from hazardous material/waste transport, treatment, storage and disposal, including vehicle liability and legal defense costs in the amount of \$1,000,000.00 as evidenced by a certificate of insurance for General, Automobile, and Environmental Liability Coverage. Proof of this insurance shall be provided to the Contracting Officer.

SC-6 DELETED.

SC-7. PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) (FAR 52.236-1): The Contractor shall perform on the site, and with its own organization, work equivalent to at least fifteen percent (15%) of the total amount of work to be performed under the Contract. The percentage may be reduced by a supplemental agreement to this Contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

SC-8. PHYSICAL DATA (APR 1984) (FAR 52.236-4): Data and information furnished or referred to below is for the Contractor's information. The Government will not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) Physical Conditions: The indications of physical conditions on the drawings and in the specifications are the result of site investigations by test holes shown on the drawings.

(b) Weather Conditions: Each bidder shall be satisfied before submitting his bid as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any National Weather Service Office.

(c) Transportation Facilities: Each bidder, before submitting his bid, shall make an investigation of the conditions of existing public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the jobsite. The unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of the work.

SC-9 DELETED.

SC-10. LAYOUT OF WORK (APR 1984) (FAR 52.236-17): The Contractor shall lay out its work from Government-established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due, or to become due, to the Contractor.

SC-11. RESERVED

SC-12 AND SC-13 DELETED.

SC-14. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAY 1999)-
(EFARS 52.231-5000)

(a) This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region VIII. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

(e) Copies of EP1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" Volumes 1 through 12 are available in Portable Document Format (PDF) and can be viewed or downloaded at <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/cecw.htm>. A CD-ROM containing (Volumes 1-12) is available through either the Superintendent of Documents or Government bookstores. For additional information telephone 202-512-2250, or access on the Internet at http://www.access.gpo.gov/su_docs.

SC-15. PAYMENT FOR MATERIALS DELIVERED OFF-SITE (MAY 1999)-(EFARS 52.232-5000)

(a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (2) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

(b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the following items: Any other construction material stored offsite may be considered in determining the amount of a progress payment.

SC-16 AND SC-17 DELETED

SC-18. CONTRACT DRAWINGS AND SPECIFICATIONS (AUG 2000)(DOD FAR SUPP 252.236-7001)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall--

- (1) Check all drawings furnished immediately upon receipt;
- (2) Compare all drawings and verify the figures before laying out the work;
- (3) Promptly notify the Contracting Officer of any discrepancies;
- (4) Be responsible for any errors which might have been avoided by complying with this paragraph (b); and
- (5) Reproduce and print contract drawings and specifications as needed.

(c) In general—

- (1) Large scale drawings shall govern small scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified in the index of drawings attached at the end of the Special Clauses.

SC-19 THROUGH SC-21 DELETED.

SC-22. EPA ENERGY STAR: The Government requires that certain equipment be Energy Star compliant. Initially, the sole Energy Star requirement shall be the self certification by the bidder that the specified equipment is Energy Star compliant. Within 3 months of the availability of an EPA sanctioned test for Energy Star compliance, the Contractor shall submit all equipment upgrades and additions for testing and provide proof of compliance to the Government upon completion of testing. Testing shall be at the Contractor's expense.

SC-23. RECOVERED MATERIALS: The Corps of Engineers encourages all bidders to utilize recovered materials to the maximum extent practicable. The attached APPENDIX R contains procurement guidelines for products containing recovered materials.

APPENDIX R

PART 247 - COMPREHENSIVE PROCUREMENT GUIDELINE FOR PRODUCTS CONTAINING RECOVERED MATERIALS

40 CFR Ch. 1 (9-1-99 Edition)

Subpart B-Item Designations

§ 247.10 Paper and paper products.

Paper and paper products, excluding building and construction paper grades.

§ 247.11 Vehicular products.

- (a) Lubricating oils containing re-refined oil, including engine lubricating oils, hydraulic fluids, and gear oils, excluding marine and aviation oils.
- (b) Tires, excluding airplane tire
- (e) Reclaimed engine coolants, excluding coolants used in non-vehicular applications.

247.12 Construction products.

- (a) Building insulation product including the following items:
 - (1) Loose-fill insulation, including but not limited to cellulose fiber, mineral fibers (fiberglass and rock vermiculite, and perlite;
 - (2) Blanket and batt insulation, including but not limited to mineral fibers (fiberglass and rock wool).
 - (3) Board (sheathing, roof decking wall panel) insulation, including but not limited to structural fiberboard and laminated paperboard products perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites; and
 - (4) Spray-in-place insulation, including but not limited to foam-in-place polyurethane and polyisocyanurate and spray-on cellulose.
- (b) Structural fiberboard and laminated paperboard products for applications other than building insulation, including building board, sheathing shingle backer, sound deadening board, roof insulating board, insulating wallboard, acoustical and non-acoustical ceiling tile, acoustical and non-acoustical lay-in panels, floor underlayments, and roof overlay (cover board).
- (c) Cement and concrete, including concrete products such as pipe and block, containing coal fly as ground granulated blast furnace (GGBF) slag.
- (d) Carpet made of polyester fiber use in low- and medium-wear applications.
- (e) Floor tiles and patio block containing recovered rubber or plastic.
- (f) Shower and restroom dividers/partitions containing recovered plastic or steel.
- (g) (1) Consolidated latex paint used for covering graffiti; and
- (2) Reprocessed latex paint used for interior and exterior architectural applications such as wallboard, ceilings, and trim; gutter boards; and concrete, stucco, masonry, wood and metal surfaces.

§247.13 Transportation products.

- (a) Traffic barricades and traffic cones used in controlling or restricting vehicular traffic.
- (b) Parking stops made from concrete or containing recovered plastic or rubber.
- (c) Channelizers containing recovered plastic or rubber.
- (d) Delineators containing recovered plastic, rubber, or steel.
- (e) Flexible delineators containing recovered plastic.

§ 247.14 Park and recreation products

- (a) Playground surfaces and running tracks containing recovered rubber or plastic.
- (b) Plastic fencing containing recovered plastic for use in controlling snow or sand drifting and as a warning/safety barrier in construction or other applications.

247.15 Landscaping products.

- (a) Hydraulic mulch products containing recovered paper or recovered wood used for hydroseeding and as an over-spray for straw mulch in landscaping, erosion control, and soil reclamation.
- (b) Compost made from yard trimmings, leaves, and/or grass clippings for use in landscaping, seeding of grass or other plants on roadsides and embankments, as a nutritious mulch under trees and shrubs, and in erosion control and soil reclamation.
- (c) Garden and soaker hoses containing recovered plastic or rubber.
- (d) Lawn and garden edging containing recovered plastic or rubber.

§ 247.16 Non-paper office product.

- (a) Office recycling containers and office waste receptacles.
- (b) Plastic desktop accessories.
- (c) Toner cartridges.
- (d) Binders.
- (e) Plastic trash bags.
- (f) Printer ribbons.
- (g) Plastic envelopes.

§ 247.17 Miscellaneous products.

Pallets containing recovered wood, plastic, or paperboard.

INDEX OF DRAWINGS

BATTLE SIMULATION CENTER
FORT LEWIS, WASHINGTON
Project Number: 25057
22s/191-90-12

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
GENERAL				
1	G-100	Cover		03APR11
2	G-101	Drawing Index/Maps	3	03MAY19
3	G-102	Drawing Index/ Maps	2	03MAY16
4	G-103	Abbreviations		03APR11
5	G-104	Abbreviations		03APR11
6	G-105	Abbreviations		03APR11
7	G-106	Locations of Exploration		03APR11
8	G-107	Boring Logs		03APR11
9	G-108	Boring Logs		03APR11
10	G-109	Boring Logs		03APR11
11	G-110	Boring Logs		03APR11
12	G-111	Boring Logs		03APR11
13	G-112	Boring Logs		03APR11
14	G-113	Boring Logs		03APR11
15	G-114	Site Survey and Utility Pothole Information		03APR11
CIVIL				
16	C-001	Civil Legend and General Construction Notes		03APR11
17	C-002	Typical Site Stripping Sections		03APR11
18	C-100	Demolition Plan		03APR11
19	C-101	Site Layout Plan	2	03MAY16
20	C-102	Site Layout Plan		03APR11
21	C-103	Site Plan Drainage and Storm Drain		03APR11
22	C-104	Site Plan Drainage and Storm Drain	2	03MAY16
23	C-105	Site Paving and Fencing	2	03MAY16
24	C-106	Sewer Plan and Profile		03APR11
25	C-107	Water Loop Plan and Profile	2	03MAY16
26	C-108	Water Loop Plan and Profile		03APR11
26A	C-109	Communications Plan and Profile, Sta. 0+00 to Sta. 15+50	3	03MAY16
26B	C-110	Communications Plan and Profile	3	03MAY16
26C	C-111	Communications Plan and Profile, Sta. 30+50 to Sta. 45+50	3	03MAY16
26D	C-112	Communications Plan and Profile, Sta. 45+50 to End	3	03MAY16
26E	C-113	Communications Plan and Profile	3	03MAY16
27	C-300	Drainage Pond Sections		03APR11
28	C-400	Drainage Ponds Enlarged Plans		03APR11

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
29	C-500	Utility Details - Sanitary Sewer		03APR11
30	C-501	Utility Details - Sanitary Sewer		03APR11
31	C-502	Utility Storm Drainage Details		03APR11
32	C-503	Utility Storm Drainage Details		03APR11
33	C-504	Utility Details - Water		03APR11
34	C-505	Utility Details - Water		03APR11
35	C-506	Miscellaneous Details - Roadway		03APR11
36	C-507	Miscellaneous Details - Roadway		03APR11
37	C-508	Miscellaneous Details - Roadway / Storm Drainage		03APR11
38	C-509	Sections and Miscellaneous Details		03APR11
39	C-510	Reinforced Drivable Turf and Paving Details		03APR11
40	C-511	Fence Details - Type A		03APR11
41	C-512	Fence Details - Type B		03APR11
42	C-513	Fence Details - Type C		03APR11
43	C-514	Gate Details		03APR11
LANDSCAPE				
44	L-101	Irrigation Plan		03APR11
45	L-102	Planting Plan		03APR11
46	L-103	Turf Seeding Plan		03APR11
47	L-501	Landscape Details		03APR11
48	L-502	Landscape Details		03APR11
STRUCTURAL				
49	S-001	General Structural Notes		03APR11
50	S-002	Structural Abbreviations and Keyplan		03APR11
51	S-100	Composite Foundation/Floor Plan		03APR11
52	S-101	Composite Roof Framing Plan		03APR11
53	S-102	Foundation/Floor Plan NW Quadrant		03APR11
54	S-103	Foundation/Floor Plan NE Quadrant		03APR11
55	S-104	Foundation/Floor Plan SE Quadrant		03APR11
56	S-105	Foundation/Floor Plan SW Quadrant		03APR11
57	S-106	Roof Framing Plan NW Quadrant		03APR11
58	S-107	Roof Framing Plan NE Quadrant		03APR11
59	S-108	Roof Framing Plan SE Quadrant		03APR11
60	S-109	Roof Framing Plan SW Quadrant		03APR11
61	S-110	Mech Well West Roof Framing Plan		03APR11
62	S-111	Mech Well East Roof Framing Plan		03APR11
63	S-112	Concrete Slab Buildup Plan		03APR11
64	S-113	Moveable Partition Wall Support Framing Plan		03APR11
65	S-300	Concrete Sections and Details	3	03MAY16
66	S-301	Concrete Sections and Details		03APR11
67	S-302	Concrete Sections and Details		03APR11
68	S-303	Concrete Sections and Details		03APR11
69	S-310	Steel Sections and Details		03APR11
70	S-311	Steel Sections and Details		03APR11

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
71	S-312	Steel Sections and Details		03APR11
72	S-400	Misc Framing Plans and Sections		03APR11
73	S-401	Catwalk Framing Plans and Sections		03APR11
74	S-402	Mech Rm Platform Framing Plan, Sections, and Details		03APR11
75	S-403	Elec Transformer Enclosure Plan and Sections		03APR11
76	S-404	Mech Equip Support Plan and Sections		03APR11
77	S-405	Guardhouse Plans and Sections		03APR11
78	S-406	Typ Entry Canopy Framing Plan, Sections, and Details		03APR11
79	S-407	North Entry Canopy Framing Plan, Sections, and Details		03APR11
80	S-500	Steel Braced Frame Details and Schedule		03APR11
81	S-501	Steel Braced Frame Details		03APR11
82	S-502	Metal Deck Details and Schedule		03APR11
83	S-503	Structural Steel Details		03APR11
84	S-504	Structural Steel Details		03APR11
85	S-505	Structural Steel Details		03APR11
86	S-600	Steel Column Schedule		03APR11
87	S-601	Steel Column Schedule (Continued)		03APR11
88	S-700	Typical Structural Details		03APR11
89	S-701	Typical Structural Details		03APR11
90	S-702	Typical Structural Details		03APR11
91	S-703	Typical Structural Details		03APR11
92	S-704	Typical Structural Details		03APR11
93	S-705	Typical Structural Details		03APR11
94	S-706	Typical Structural Details		03APR11
95	S-707	Typical Structural Details		03APR11
96	S-708	Typical Structural Details		03APR11
97	S-709	Typical Structural Details		03APR11
ARCHITECTURAL				
98	A-001	Architectural Symbols and General Notes		03APR11
99	A-002	General Code Information		03APR11
100	A-003	Code / Occupancy Floor Plan		03APR11
101	A-100	Floor Plan - Composite		03APR11
102	A-101	Upper Floor Plan - Composite		03APR11
103	A-102	Floor Plan NW Quadrant		03APR11
104	A-103	Floor Plan NE Quadrant		03APR11
105	A-104	Floor Plan SE Quadrant		03APR11
106	A-105	Floor Plan SW Quadrant		03APR11
107	A-106	Floor Plan – West Upper Level		03APR11
108	A-107	Floor Plan - East Upper Level		03APR11
109	A-108	Floor Plan - North Upper Level		03APR11
110	A-109	Roof Plan		03APR11
111	A-112	Reflected Ceiling Plan NW Quadrant		03APR11
112	A-113	Reflected Ceiling Plan NE Quadrant		03APR11
113	A-114	Reflected Ceiling Plan SE Quadrant		03APR11
114	A-115	Reflected Ceiling Plan SW Quadrant		03APR11

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
115	A-200	Exterior Elevations		03APR11
116	A-201	Exterior Elevations		03APR11
117	A-300	Building Sections		03APR11
118	A-301	Building Sections		03APR11
119	A-306	Wall Sections		03APR11
120	A-307	Wall Sections		03APR11
121	A-308	Wall Sections		03APR11
122	A-309	Wall Sections		03APR11
123	A-310	Wall Sections		03APR11
124	A-311	Wall Sections		03APR11
125	A-312	Wall Sections		03APR11
126	A-313	Wall Sections		03APR11
127	A-314	Wall Sections		03APR11
128	A-315	Wall Sections		03APR11
129	A-400	Enlarged Plans / Interior Elevations		03APR11
130	A-401	Enlarged Plans / Interior Elevations		03APR11
131	A-402	Enlarged Plans / Interior Elevations		03APR11
132	A-403	Interior Elevations		03APR11
133	A-404	Interior Elevations		03APR11
134	A-405	Interior Elevations		03APR11
135	A-406	Interior Elevations		03APR11
136	A-407	Interior Elevations		03APR11
137	A-410	Stair Plans		03APR11
138	A-411	Stair Plans		03APR11
139	A-500	Storefront Details		03APR11
140	A-501	Door Details		03APR11
141	A-502	Door Details		03APR11
142	A-503	Guardhouse Door/Window Details		03APR11
143	A-504	Window Details		03APR11
144	A-505	Exterior Details		03APR11
145	A-506	Exterior Details		03APR11
146	A-507	Exterior Details		03APR11
147	A-508	Canopy Details		03APR11
148	A-509	Canopy Details		03APR11
149	A-510	Details		03APR11
150	A-511	Interior Details		03APR11
151	A-512	Interior Details		03APR11
152	A-513	Casework Details		03APR11
153	A-514	Casework/Misc. Details		03APR11
154	A-515	Casework/Misc. Details		03APR11
155	A-600	Wall Types		03APR11
156	A-601	Wall Types (Cont.), Floor Assemblies		03APR11
157	A-602	Ceiling Assemblies, Roof Assemblies		03APR11
158	A-603	Window Types, Window Schedules		03APR11
159	A-604	Door Types, Door Schedule		03APR11

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
160	A-605	Door Schedule Continued		03APR11
161	A-606	Room Finish Schedule		03APR11
162	A-607	Room Finish Schedule		03APR11
163	A-608	Signage Schedule and Details		03APR11
164	A-609	Framing Details		03APR11
165	A-700	Guardhouse Floor Plan / Guardhouse RCP		03APR11
166	A-701	Guardhouse Exterior Elevations		03APR11
167	A-702	Guardhouse Wall Sections		03APR11
168	A-703	Guardhouse Interior Elevations/Casework Details		03APR11
168A	A-704	Building 2003 Addition	3	03MAY19
INTERIORS				
169	I-102	Furniture Plan NW Quadrant		03APR11
170	I-103	Furniture Plan NE Quadrant		03APR11
171	I-104	Furniture Plan SE Quadrant		03APR11
172	I-105	Furniture Plan SW Quadrant		03APR11
173	I-112	Floor Finish Plan NW Quadrant		03APR11
174	I-113	Floor Finish Plan NE Quadrant		03APR11
175	I-114	Floor Finish Plan SE Quadrant		03APR11
176	I-115	Floor Finish Plan SW Quadrant		03APR11
MECHANICAL				
177	M-001	Mechanical Legend		03APR11
178	M-101	HVAC Roof Plan		03APR11
179	M-102	HVAC Plan Northwest Quadrant		03APR11
180	M-103	HVAC Plan Northeast Quadrant		03APR11
181	M-104	HVAC Plan Southeast Quadrant		03APR11
182	M-105	HVAC Plan Southwest Quadrant		03APR11
183	M-106	HVAC Plan Guardhouse		03APR11
184	M-300	HVAC Sections		03APR11
185	M-400	Chilled Layout and Mechanical Room Layout		03APR11
186	M-501	Mechanical Details		03APR11
187	M-502	Mechanical Details		03APR11
188	M-503	Mechanical Details		03APR11
189	M-504	Mechanical Details		03APR11
190	M-601	HVAC and Plumbing Schedules		03APR11
191	M-602	HVAC and Plumbing Schedules		03APR11
192	M-603	HVAC and Plumbing Schedules	3	03MAY16
193	M-604	HVAC Control Diagrams		03APR11
194	M-605	HVAC Control Diagrams		03APR11
195	M-606	HVAC Control Diagrams		03APR11
PLUMBING				
196	P-001	Piping Legend and Schedules		03APR11
197	P-102	Foundation Plumbing Plan Northwest Quadrant		03APR11
198	P-103	Foundation Plumbing Plan Northeast Quadrant	3	03MAY16
199	P-104	Foundation Plumbing Plan Southeast Quadrant		03APR11

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
200	P-105	Foundation Plumbing Plan Southwest Quadrant		03APR11
201	P-106	Piping Plan Northwest Quadrant		03APR11
202	P-107	Piping Plan Northeast Quadrant		03APR11
203	P-108	Piping Plan Southeast Quadrant		03APR11
204	P-109	Piping Plan Southwest Quadrant		03APR11
204A	P-110	Gasline Plan, Profile and Details	2	03MAY16
205	P-500	Piping Details		03APR11
206	P-600	Plumbing Isometrics		03APR11
207	P-601	Plumbing Isometrics		03APR11
FIRE				
208	F-101	Fire Protection Plan		03APR11
209	F-102	Fire Alarm Plan Northwest Quadrant		03APR11
210	F-103	Fire Alarm Plan Northeast Quadrant		03APR11
211	F-104	Fire Alarm Plan Southeast Quadrant		03APR11
212	F-105	Fire Alarm Plan Southwest Quadrant		03APR11
213	F-500	Fire Sprinkler Details		03APR11
214	F-600	Fire Alarm Riser Diagram and Details		03APR11
ELECTRICAL				
215	E-001	Electrical General Notes and Luminaire Schedule		03APR11
216	E-002	Electrical Abbreviations and Legend		03APR11
217	E-100	Electrical Area Plan		03APR11
218	E-101	Electrical Site Plan		03APR11
219	E-102	Lighting Plan Northwest Quadrant		03APR11
220	E-103	Lighting Plan Northeast Quadrant		03APR11
221	E-104	Lighting Plan Southeast Quadrant		03APR11
222	E-105	Lighting Plan Southwest Quadrant		03APR11
223	E-106	Electrical Roof Plan		03APR11
224	E-107	Power Plan Northwest Quadrant		03APR11
225	E-108	Power Plan Northeast Quadrant		03APR11
226	E-109	Power Plan Southeast Quadrant		03APR11
227	E-110	Power Plan Southwest Quadrant		03APR11
228	E-111	Typical Conduit Plan		03APR11
229	E-112	Lightning Protection System Plan		03APR11
230	E-113	Grounding System Plan		03APR11
231	E-400	Electrical Room and Substation Plan and Details		03APR11
232	E-401	Guardhouse Lighting and Power Plans		03APR11
233	E-500	Electrical Site Details		03APR11
234	E-501	Lightning Protection System Details		03APR11
235	E-502	Electrical Miscellaneous Details		03APR11
236	E-600	Power One-Line Diagram	2	03MAY16
237	E-601	Distribution Panel Schedules		03APR11
238	E-602	Distribution Panel Schedules		03APR11
239	E-603	Distribution Panel Schedules		03APR11

AUDIO/VISUAL

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
240	AV001	Audiovisual Symbols and Abbreviations		03APR11
241	AV100	Main Floor Plan Audiovisual		03APR11
242	AV102	NW Quadrant AV Infrastructure		03APR11
243	AV103	NE Quadrant AV Infrastructure		03APR11
244	AV104	SW Quadrant AV Infrastructure		03APR11
245	AV105	SE Quadrant AV Infrastructure		03APR11
246	AV411	AV Room Details NE Quadrant		03APR11
247	AV421	AV Room Details SE Quadrant		03APR11
248	AV431	AV Room Details 122C-F		03APR11
249	AV432	AV Room Details 122A-B, 122G-H		03APR11
250	AV433	AV Room Details 123A-B, 126A-B		03APR11
251	AV434	AV Room Details 124A-D, 125A-D		03APR11
252	AV501	Installation Details Audiovisual		03APR11
253	AV502	Installation Details Audiovisual		03APR11
TELECOMMUNICATIONS				
254	T-000	Telecommunications Symbols and Abbreviations		03APR11
255	T-001	Telecommunications Exterior Conduit and T.I.P. Plan		03APR11
256	T-100	Telecommunications Main Floor Plan	2	03MAY16
257	T-100A	Telecommunications Main Floor Plan Overhead Cable Tray		03APR11
258	T-100B	Telecommunications Main Floor Plan Underfloor Cable Tray		03APR11
259	T-101	Mezzanine Floor Plan		03APR11
260	T-102	Telecommunications NW Quadrant	2	03MAY16
261	T-102A	Telecommunications NW Quadrant Overhead Cable Tray		03APR11
262	T-102B	Telecommunications NW Quadrant Underfloor Cable Tray		03APR11
263	T-103	Telecommunications NE Quadrant		03APR11
264	T-103A	Telecommunications NE Quadrant Overhead Cable Tray		03APR11
265	T-103B	Telecommunications NE Quadrant Underfloor Cable Tray		03APR11
266	T-104	Telecommunications SE Quadrant		03APR11
267	T-104A	Telecommunications SE Quadrant Overhead Cable Tray		03APR11
268	T-104B	Telecommunications SE Quadrant Underfloor Cable Tray		03APR11
269	T-105	Telecommunications SW Quadrant		03APR11
270	T-105A	Telecommunications SW Quadrant Overhead Cable Tray		03APR11
271	T-105B	Telecommunications SW Quadrant Underfloor Cable Tray		03APR11
272	T-106	Telecommunications Mezzanine Plan East		03APR11
273	T-107	Telecommunications Mezzanine Plan West		03APR11
274	T-108	Telecommunications Guard House		03APR11
274A	T-200	Telecommunications Site Plan Existing Duct Bank Route		03APR30
274B	T-201	Telecommunications Site Plan New Duct Bank Route		03APR30
274C	T-202	Telecommunications Site Plan New Duct Bank Route		03APR30
274D	T-203	Telecommunications Site Plan Existing Duct Bank Route		03APR30
274E	T-204	Telecommunications Site Plan New Duct Bank Route		03APR30

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
274F	T-205	Telecommunications Site Plan New Duct Bank Route		03APR30
274G	T-206	Telecommunications OSP Copper Backbone Cabling Diagram		03APR30
274H	T-207	Telecommunications OSP Fiber Backbone Cabling Diagram		03APR30
274 I	T-300	Telecommunications MSTF Hut & Range Control Floor Plans		03APR30
274J	T-400	Telecommunications Security Plan	2	03MAY16
275	T-500	Telecommunications NOC Overview Room Detail		03APR11
276	T-501	Telecommunications DOIM/DSN/NIPR Room Detail		03APR11
277	T-501A	Telecommunications DOIM/DSN/NIPR Rack Detail		03APR11
278	T-501B	Telecommunications DOIM HOMACO Frame Details		03APR11
279	T-502	Telecommunications LH/Reach Room Detail		03APR11
280	T-503	Telecommunications SIPR RPPM Detail		03APR11
281	T-504	Telecommunications SIM/STIM Room Detail		03APR11
282	T-505	Telecommunications MSE Room Detail		03APR11
283	T-505A	Telecommunications MSE/FM Rack Detail		03APR11
284	T-506	Telecommunications C2 WAN Room All Details		03APR11
285	T-507	Telecommunications BSC/COMMO Room 1044 Details		03APR11
286	T-508	Telecommunications BSC/COMMO Room 104d Details		03APR11
287	T-509	Telecommunications BSC/COMMO Room 109b Details		03APR11
288	T-510	Telecommunications BSC/COMMO Room 107b Details		03APR11
289	T-511	Telecommunications BSC/COMMO SCIF Room 105d Details		03APR11
290	T-512	Telecommunications BSC/COMMO Room 118c Details		03APR11
291	T-513	Telecommunications BSC/COMMO Room 119a Details		03APR11
292	T-514	Telecommunications BSC/COMMO Room 127a Details		03APR11
293	T-515	Telecommunications BSC/COMMO Room 130a Details		03APR11
294	T-600	Telecommunications NOC Inter-Connectivity Diagram	1	03APR30
295	T-601	Telecommunications DSN Conduit & Cabling Riser Diagram	1	03APR30
296	T-601A	Telecommunications DSN Conduit Riser Diagram	1	03APR30
297	T-602	Telecommunications MSE Conduit & Cabling Riser Diagram	1	03APR30
298	T-603	Telecommunications SIPRNET Conduit & Cable Riser Diagram	1	03APR30
299	T-603A	Telecommunications SIPRNET Conduit Riser Diagram	1	03APR30
300	T-604	Telecommunications NIPRNET Conduit & Cable Riser Diagram	1	03APR30
301	T-605	Telecommunications C2 WAN Cabling Riser Diagram	1	03APR30
302	T-605A	Telecommunications C2 WAN Conduit Riser Diagram	1	03APR30
303	T-606	Telecommunications SIM/STIM Conduit & Cabling Riser Diagram	1	03APR30
304	T-607	Telecommunications LH Reach Conduit & Cabling Riser Diagram	1	03APR30
305	T-700	Details		03APR11

SHEET NUMBER	PLATE NUMBER	TITLE	REVISION NUMBER	DATE
306	T-701	Details		03APR11
307	T-702	Details		03APR11
308	T-800	Telecommunications BSC Conduit Run Schedule		03APR11

DRAWING REVISIONS BY NOTATION

Drawing Index. Sheet 2, Plate G-101

- (a) Change drawing title to "Drawing Index/Maps" for Sheet 2, Plate G-101
- (b) Change drawing title to "Drawing Index/Maps" for Sheet 3, Plate G-102

Foundation/Flr Plan NE Quadrant, Sheet 54, Plate S-103

- (a) Delete footing designation "F6" located near Grid J-4.

Section "A", Sheet 66, Plate S-301

Revise footing thickness shown in Section A from 1'-0" [305] to 1'-3" [381] to match thickness shown in Concrete Footing Schedule on Plate S-300.

Floor Plan Northeast Quadrant, Sheet 104, Plate A-103

Add wall type "10C" between rooms "Mechanical 115A" and "Electrical 115B".

Window Types Window Schedules, Sheet 158, Plate A-603

Note: The following windows repeat themselves in the schedule, and need only appear once.

Room Finish Schedule, Sheet 161, Plate A-606

Room 104A, Ceiling Assembly should be "O.T.S", in lieu of "CA-3"

Civil Layout Plan, Sheet 19, Plate C-101

- (a) Add the following to the plan of this Sheet:

Expand the amount of the concrete pad at the northeast side of the building, as shown on the revised detail of Plate S-403. (For the diesel engine-generator.)

Composite Foundation/Floor Plan, Sheet 51, Plate S-100

- (a) For modifications (not shown) to electrical transformer and generator enclosure located near Grid H-3.1, see revised plan on Sheet 75, Plate S-403.

- (b) Revise diagonal screened patterning lines located on Drawing S-100 between approximate Grids B.2-D/4-5 from “dashed” to “solid” to match and reflect the “6-inch [152] raised floor system” patterning shown in the sheet Legend. NOTE: Patterning in this area to match the floor patterning shown in the SIM BAY’s.

Foundation/Flr Plan NE Quadrant, Sheet 54, Plate S-103

- (a) Revise note callout located near Grid H.7-3 to read “Elec Transformer & Generator Enclosure, see Sheet S-403” to reflect addition of electrical generator equipment; for enclosure modifications not shown, see revised plan on Sheet 75, Plate S-403.

Elec Transformer & Generator Enclosure Plan and Section, Sheet 75, Plate S-403

- (a) Revised overall sheet title to read “Elec Transformer & Generator Enclosure Plan and Section” to reflect addition of electrical generator equipment.

Elec Transformer & Generator Enclosure Plan and Section, Sheet 75, Plate S-403

- (a) Modified and revised PLAN to accommodate new electrical generator equipment. Modifications included eastward extension of thickened concrete slab-on-grade, extension of enclosure wall system (CMU wall with exterior brick veneer), addition of Notes 5 & 6, and modification of the title to reflect the electrical generator equipment addition.
- (b) See attached sheet SD-1 (Elec Transformer & Generator Enclosure Plan, Plate S-403).

Elec Transformer & Generator Enclosure Plan and Section, Section A, Sheet 75, Plate S-403

- (a) Modified slab thickness callout to reflect increased thickness at slab extension required for new electrical generator equipment.
- (b) See attached sheet SD-2 (Section A, Plate S-403).

Floor Plan Southwest Quadrant, Sheet 106, Plate A-105

- (a) Room 118B, Add wall type “11A” to north and east walls.
- (b) Room 119B, Add wall type “11A” to north and west walls.

Room Finish Schedule, Sheet 161, Plate A-606

- (a) Delete “WM-3 at ext. entry” from the remarks column at Rooms 105A, 115A, 115B, 116B and 116C.

HVAC and Plumbing Schedules, Sheet 191, Plate M-602

- (a) AIR HANDLING UNIT SCHEDULE
For AHU-3 Supply Fan ESP IN WG shall be revised to 1.75”

(b) AIR HANDLING UNIT SCHEDULE

Revise NOTE 2 to read as follows: Provide for single point electrical connection including transformers, breakers for controls, lights, etc. All supply and return fans shall be furnished with a factory mounted and wired VFD except AHU-2. AHU-2 shall only have a VFD associated with the return fan.

HVAC Control Diagram, Sheet 193, Plate M-604

- (a) AHU-1, 3, 4, 5 shall have a return duct CO2 sensor. Sensor to be located in an accessible location.
- (b) AHU-2 shall have a wall mounted CO2 sensor. Locate sensor near thermostat.
- (c) Provide a CO2 sensor to read the CO2 level of the outdoor air in each air handler. Locate sensors in the outside air plenum of the air handler. Install so the sensor is reading only the outside air stream.
- (d) Sequence of operation for CO2 sensor:
CO2 sensors for inside the building shall compare the CO2 levels against the outside air CO2 sensors and shall maintain the inside air CO2 levels to not greater than 530 PPM greater than the CO2 levels of the outside air. CO2 sensors shall override mixed air sensors/outside air dampers to not exceed the maximum indoor CO2 levels. Outside air dampers shall modulate from full open to full closed. Dampers shall maintain minimum outside air position as required maintain building pressure.

Piping Plan Northwest Quadrant, Sheet 201, Plate P-106

- (a) There is a discrepancy between the location of PF-6 on the Plumbing Drawing and the Architectural Drawings. Refer to the sheet A-102 for the actual location of the sink. The sink is actually located approximately 6' to the west of the location show on the mechanical drawings. Adjust the piping to match the actual location of the sink. PF-6 is a Kitchen Sink

Electrical General Notes, Sheet 215, Plate E-001

- (a) Add the following to the end of Telecommunication Requirements box of this Sheet:

Contact information for Spider Manufacturing:

Telephone: (250) 765-2616

Fax: (250) 765-2614

website address: www.spidermfg.com

mailing address: #5-364 Loughheed Rd., Kelowna, BC, Canada V1X 7R8

Electrical General Notes and Luminaire Schedule, Sheet 215, Plate E-001

- (a) Clarification: Fixture type S4 referenced on Luminaire Schedule shall be fixture type B4.
- (b) Clarification: Fixture type C2 is not used on this project.

Electrical Area Plan, Sheet 217, Plate E-100

- (a) Replace the last two lines of Note 1 of this Sheet with the following:

“...data cables provided by Communications Subcontractor; cable TV – coaxial (Commcast) cable provided by vendor through contract with the General Contractor.”

- (b) Replace the last sentence of Note 15 of this Sheet with the following:

“Remove cable at a minimum to the point of pole (S3)36, as shown on the Drawing; the cut end of any remaining portion of abandoned cable shall be encapsulated and sealed to achieve a permanent watertight condition. All lead-sheath cable which is removed shall be disposed of in accordance with Section 02220 DEMOLITION. The cable shall be replaced with a new cable, as shown on the T-series (Telecommunications) drawings/addendum.”

Electrical Site Plan, Sheet 218, Plate E-101

- (a) Add the following to the plan of this Sheet:

Locate the diesel engine-generator at the east end of the unit substation (Note 3). The expanded pad is shown on the revised detail of Plate S-403.

Lighting Plan Northwest Quadrant, Sheet 219, Plate E-102

- (a) In Note 8, replace “Type D2” with “Type D6”.
(b) Clarification: All Type D6 fixtures shall be a dimming type.

Electrical Room and Substation Plan and Details, Sheet 231, Plate E-400

- (a) Add the following to Detail 3 of this Sheet:

Add (2) additional ground rods beyond the east end of the expanded pad / enclosure (to accommodate the engine-generator, as shown on the revised detail of Plate S-403) and connect to the ground ring with #3/0 bare copper ground conductor. Provide (2) connections from the buried ground conductor to the engine-generator frame and ground bus, in accordance with the manufacturer's instructions.

Distribution Panel Schedules, Sheet 239, Plate E-603

- (a) Add the following to the schedule for Panel SNK:

Add a 3-pole, 60A circuit breaker at pole positions 37, 39, 41 for the generator panel; 3000 va load on each of the phases.

DRAWING REVISIONS BY NOTATION AMENDMENT R0007

Irrigation Plan, Sheet 44, Plate L-101

- (a) Delete “and in Section 02811, “Landscape Irrigation” from the last line of the option item description

Planting Plan, Sheet 45, Plate L-102

- (a) Delete “and in Section 02930, “Exterior Plants” from the last line of the option item description

Roof Framing Plan – NW Quadrant, Sheet 57, Plate S-106

Add Plan note “8” as follows:

- (b) Provide elevated structural platform for suspended electrical transformers located just north of Grid 5 near Grid C (typ of 3 places total) as follows:

- A. Platform system shall be able to support self weight plus 1000 lbs equipment dead load for each electrical transformer unit (TXPCP4, TXPCP5, and TXNA units; 3 total).
- B. Platform shall consist of 36” x 36” steel frame system with 3/16-inch steel plate cover welded to each steel frame support member. Unless otherwise noted, locate bottom of platform 2’-0” above finish ceiling; coord with arch, mech, and elec.
- C. Platforms shall be located as required in plan view (near location shown on electrical plans - see Drawing E-107) to align with roof joist panel point layout, coord with joist manufacturer.
- D. Steel frame system shall consist of C4x5.4 perimeter support members and (2) C4x5.4 interior support members located directly under each transformer equipment support; channel support members shall have welded (3/16-inch fillet all-around) end connections.
- E. Platform shall be suspended from roof joist system using (4) 3/8-inch diameter threaded rods (typ 1 per corner; 4 per unit) with double nut connection at top and bottom connections. Threaded rods shall be connected to channel platform support frame at bottom.
- F. Threaded rod top connection shall be connected to Unistrut P1000 structural support system (or approved equal) supported on roof joist bottom chords and located adjacent to joist bottom chord panel points where possible. Provide joist stiffeners as reqd, see Detail 5/S-705.
- G. Provide diagonal lateral bracing support of suspended platforms along each edge of platform and in both directions (total of 8 braces per platform). Bracing shall consist of one or more of the following: (1) hanger wire per Spec Section 09510 ACOUSTICAL CEILINGS, aircraft cable (1/8” dia minimum) with turnbuckle system, Unistrut support system, or other approved system. Each lateral brace support shall be capable of supporting a minimum of 200 lbs tension force. Lateral braces shall be connected to roof joist top chord members where possible. Provide additional joist cross brace

bridging at locations where lateral brace system connects to joist bottom chord members.

H. Transformer equipment shall be connected to platform steel channel with 5/8-inch diameter bolts (minimum one per corner); coord size and location with equipment manufacturer.

I. Contractor shall be responsible to coordinate final electrical transformer equipment support dead load reactions and locations with roof joist manufacturer prior to design and fabrication of roof joists.

Exterior Details, Sheet 145, Plate A-505

(a) Detail 10/A-506. Add notes pointing to infill wall at WF rail. "20 ga, 2 ½ inch studs at 16" o.c., (1) layer 5/8" glass-matt faced gypsum panel"

Exterior Details, Sheet 145, Plate A-506

(a) Detail 3/A-506, Delete note that reads "2 ½" [64] Metal Stud Framing".

Comm Connection at Building 2003, Sheet 168a, Plate A-704

(a) Add a general note that all work on this sheet is part of Option Item No. 0013.

Furniture Floor Plan Northwest Quadrant, Sheet 169, Plate I-102

(c) Revise General Note 2 to read as follows:
"See Specification Section 12705 for typical systems furniture layouts and components list"

Furniture Floor Plan Northeast Quadrant, Sheet 170, Plate I-103

(a) Revise General Note 2 to read as follows:
"See Specification Section 12705 for typical systems furniture layouts and components list"

Furniture Floor Plan Southeast Quadrant, Sheet 171, Plate I-104

(a) Revise General Note 2 to read as follows:
"See Specification Section 12705 for typical systems furniture layouts and components list"

Furniture Floor Plan Southwest Quadrant, Sheet 172, Plate I-105

(a) Revise General Note 2 to read as follows:
"See Specification Section 12705 for typical systems furniture layouts and components list"

HVAC Plan – SE Quadrant, Sheet 181, Plate M-104

On Sheet M-04 at approximately grid 9.3/E.9 Key Note #6 points to a 18" diameter duct. Key note #6 does not apply to this particular piece of ductwork. Delete this note reference to the 18" diameter duct.

Telecommunications OSP Copper Backbone Cabling Diagram, Sheet 274G, Plate T-206

- (a) Copper cable routed between V#12 and V#16 shall be changed to PE-89 300 pair from 700 pair as currently shown on drawing.

Details, Sheet 306, Plate T-701

- (a) Add general note that states; "MSE and FM outlets use Category 6 cable. FM outlets have one set of binding posts and MSE outlets have two sets of binding posts required. Each FM and MSE outlet gets (1) Cat 6 cable pulled to it. A typical Cruz box will require (6) Cat 6 cables for the FM and MSE outlets since there are (3) FM and (3) MSE outlets. In the Commo Rooms these Cat 6 cables will terminate on the 66 wall field for MSE/FM. Coordinate exact pair termination with owner."

Electrical General Notes and Luminaire Schedule, Sheet 215, Plate E-001

- (b) Clarification: Fixture type S4 referenced on Luminaire Schedule shall be fixture type B4.
- (c) Clarification: Fixture type C2 is not used on this project.

Lighting Plan Northwest Quadrant, Sheet 219, Plate E-102

- (c) In Note 8, replace "Type D2" with "Type D6".
- (d) Clarification: All Type D6 fixtures shall be a dimming type.

Electrical Room and Substation Plan and Details, Sheet 231, Plate E-400

- (a) Detail 3/E-400, Electrical Room and Substation Plan - TXPCP9 should be located in the transformer rack, not TXPCP4, as this was mislabeled.
- (b) Locations for TXPCP4 and TXPCP5 are shown on Drawing E-107.
- (c) Mounting for TXPCP4, TXPCP5, and TXNA on platforms from the roof structure is addressed in this Amendment 0007, in association with the structural drawings / package.

Foundation/F1r Plan NE Quadrant, Sheet 54, Plate S-103

- (a) Delete footing designation "F6" located near Grid J-4.

Section "A", Sheet 66, Plate S-301

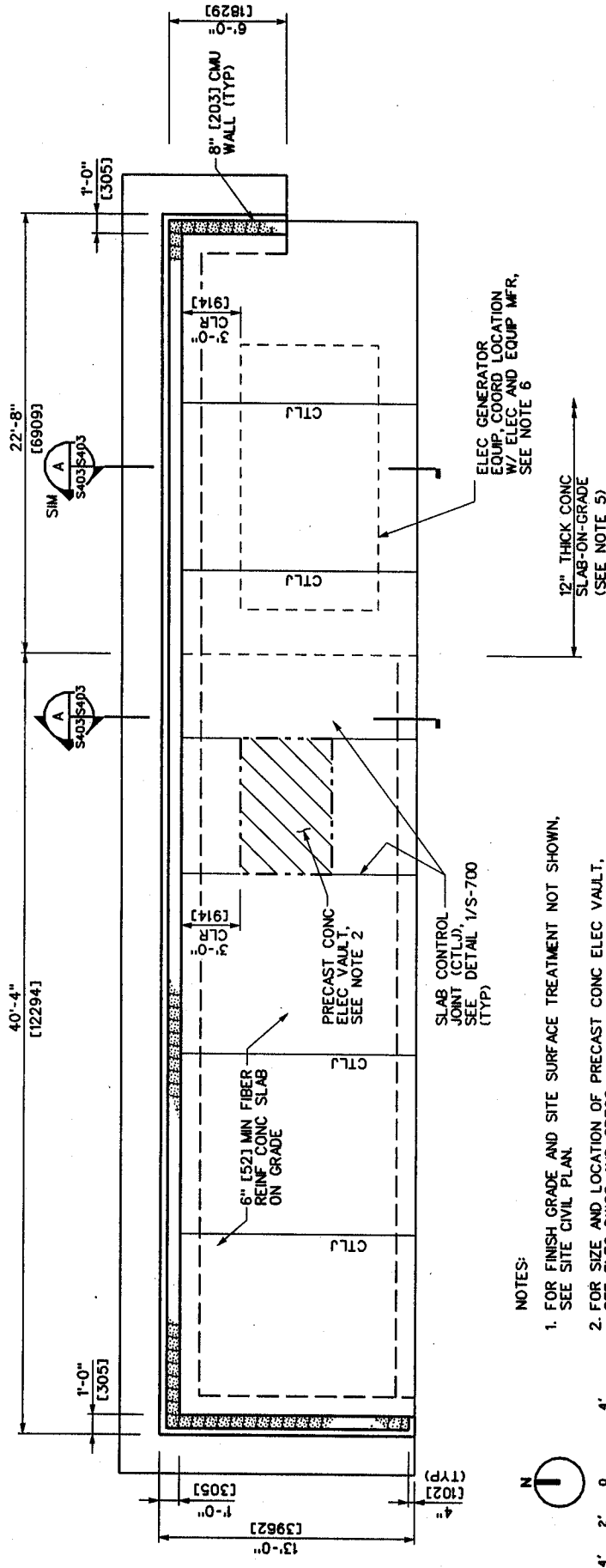
- (a) Revise footing thickness shown in Section A from 1'-0" [305] to 1'-3" [381] to match thickness shown in Concrete Footing Schedule on Plate S-300.

STANDARD DETAILS BOUND IN THE SPECIFICATIONS

DRAWING NUMBER	SHEET NUMBER	TITLE	DATE
<u>SECTION 01501 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS</u>			
49s/40-05-15	1 & 2	U.S. Army Project Construction Sign	84JUN20
	1	Hard Hat Sign	10SEP90

Attachments follow.

REVISED
ADDENDUM
No. 2



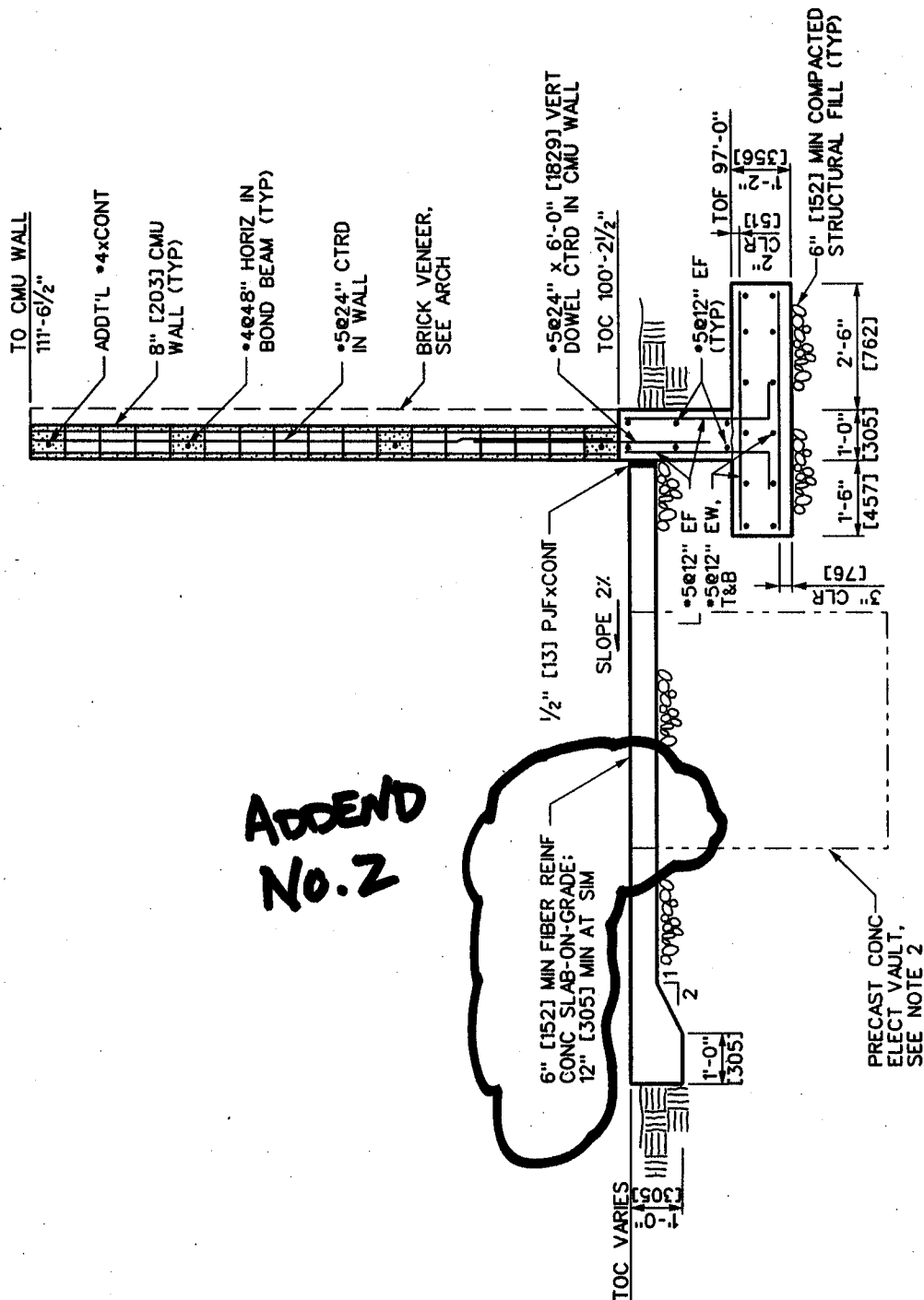
NOTES:

1. FOR FINISH GRADE AND SITE SURFACE TREATMENT NOT SHOWN, SEE SITE CIVIL PLAN.
2. FOR SIZE AND LOCATION OF PRECAST CONC ELEC VAULT, SEE ELEC DWGS AND SPECS.
3. FOR EXTER BRICK VENEER AND PRECAST CONC WALL CAP NOT SHOWN, SEE ARCH.
4. FOR ADDT REIN AT CMU WALL CORNERS/INTERSECTIONS AND WALL OPNGS, SEE DETAILS 1/S-701 AND 2/S-701 RESPECTIVELY.
5. PROVIDE #5@12" REIN EW, T&B IN 12-INCH THICK CONC SLAB ON GRADE, EXTEND REIN 3'-0" INTO 6-INCH CONC SLAB ON GRADE.
6. COORD LOCATION OF ELEC GENERATOR EQUIP WITH ELEC AND EQUIP MFR. EQUIP SHALL BE ANCHORED IN ACCORDANCE WITH EQUIP MFR RECOMMENDATIONS (MIN OF 3/4" DIA CONC ANCHOR AT EA CORNER AND AT 4 FT [1219] O.C. ALONG PERIM).

ELEC TRANSFORMER & GENERATOR ENCLOSURE PLAN
1/4"=1'-0"

SD-1

S-403



**ADDEND
No. 2**

1. NOTES:
FOR BRICK VENEER AND ARCH PRECAST CONC
WALL CAP NOT SHOWN, SEE ARCH.
2. FOR PRECAST CONC ELEC VAULT SIZE AND
DETAILS NOT SHOWN, SEE ELEC DWGS AND
SPECS.
3. FOR TOP OF CONC SLAB ELEVATIONS NOT SHOWN,
SEE CONC CIVIL SITE PLAN.

A SECTION
S403/S403 1/2"=1'-0"

SD-2

S-403

SECTION 01270

PAYMENT

PART 1 GENERAL

1.1 GENERAL

The contract price for each item shall constitute full compensation for furnishing all plant, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the items in accordance with these specifications and the applicable drawings, including surveying performed by the Contractor. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. No separate payment will be made for the work, services, or operations required by the Contractor, as specified in DIVISION 1, GENERAL REQUIREMENTS, to complete the project in accordance with these specifications; all costs thereof shall be considered as incidental to the work.

1.2 PAYMENT

1.2.1 ITEM NO. 0001 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0001, All Work for Construction of the Battle Simulation Center within a line 5 feet outside of the building exterior walls, except for Optional Items 0007, 0008 and 0009, payment of which shall constitute full compensation for Item No. 0001, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction. See Option Items 0007, 0008, 0011 and 0012 for work referenced in this item.

1.2.2 ITEM NO. 0002 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0002, Construction of all Site Work and Utility Work from a line 5 feet outside of the building exterior walls, except for Optional Items 0010 through 0015, payment of which shall constitute full compensation for Item No. 0002, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

1.2.3 ITEM NO. 0003 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0003, All Work for As-Built Drawings in Electronic Format as specified in Section 01702 from preparation to final approval, payment of which shall constitute full compensation for Item No. 0003, complete. No partial or total payment will be made for this item until the as-built drawings, both marked up blue prints and electronic files are fully approved by the Government (A or B action) and all copies of approved drawings and electronic media received by the Government. The dollar amount specified in the Bid Schedule may not necessarily reflect the bidder's actual costs for doing this work.

1.2.4 ITEM NO. 0004 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0004, All Work for O&M Manuals as specified in Section 01701 from preparation to final approval, payment of which shall constitute full compensation of Item No. 0003 complete. No partial or total payment will be made for this item until all O&M manuals are fully approved by the Government (A or B action) and all copies of final manuals are received by the Government in their final binders. The dollar amount specified in the Bid Schedule may not necessarily reflect the bidder's actual costs for doing this work.

1.2.5 ITEM NO. 0005 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0005, All Work for Form 1354 Checklist and Equipment in Place List as specified in Sections 01704 and 01705 from preparation to final approval, payment of which shall constitute full compensation of Item No. 0004 complete. No partial or total payment will be made for this item until both the 1354 Checklist and Equipment in Place List are fully approved by the Government (A or B action) and all copies of approved lists received by the Government. The dollar amount specified in the Bid Schedule may not necessarily reflect the bidder's actual costs for doing this work.

1.2.6 ITEM NO. 0006 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0006, Provide all supervision, personnel, equipment, transportation, material, and other items and services necessary to operate, service and maintain the Battle Simulation Center, Fort Lewis, Washington for the First Year after completion of construction in accordance with the requirements specified in Technical Specification 01830 Operation and Maintenance, payment of which shall constitute full compensation for Item No. 0006, complete.

1.2.7 ITEM NO. 0007 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0007, All Work for Construction of OPERABLE PARTITIONS, listed as doors D122A2, D122B2, D122C2, D122D2, D122E2, D122F2, D122G2 AND D122H2, and subsequent passage doors D122A4, D122B3, D122C4, D122D3, D122E4, D122F3, D122G4 and D122H3, identified as option item on the drawings, in lieu of extension of Wall Type 10F into intended openings and door assemblies designated to be D300, payment of which shall constitute full compensation for Item No. 0007, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

Associated work that is part of Base Item 0001, and is not to be construed as part of Item No. 0007, includes but is not limited to the following:

Operable partition support framing, including WF beam support member and associated bracing, as shown in detail 8 on Sheet A-511, and as indicated on Structural drawing S-113.

1.2.8 ITEM NO. 0008 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0008, All Work for Construction of the SUSPENDED CATWALK AND ASSOCIATED STAIRS, identified as an

option on the drawings, in lieu of extension of adjacent wall types through door locations, as indicated on Plates A-106 and A-107, payment of which shall constitute full compensation for Item No. 0008, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

This item includes but is not limited to: All catwalk framing members, including steel supports, hangers and metal grating, as indicated on S-401, Catwalk framing plan and sections. Work includes stairs as depicted in Structural drawings, and as indicated on Plate A-410. Work also includes Doors D200A1, D200A2, D200B1, D200B2, D200C1, D200D1 and D200D2. Catwalk is also depicted in Architectural Sections on Plates A-309, A-310, A-314 and A-315.

Associated work that is part of Base Item 0001, and is not to be construed as part of this option item, includes but is not limited to the following:

Roof access platform through Mechanical Room 115A, as indicated on Structural drawing S-402, and on Architectural drawing A-411.

1.2.9 ITEM NO. 0009 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0009, All Work for Construction of the ROOF PAVER SYSTEM, identified as option item on the drawings, in lieu of 30" walking matt membrane that is shown dashed, and noted on Roof Plan, A-109, payment of which shall constitute full compensation for Item No. 0009, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

1.2.10 ITEM NO. 0010 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0010, All Work for Design and Construction of the Concrete Pad, Pad Mounted EMERGENCY GENERATOR, Associated Underground Site Work, Connections and Equipment, as specified, payment of which shall constitute full compensation for Item No. 0010, complete. [This item includes concrete pad extension and extension of CMU screenwall.](#) Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

Drawings and specifications describing the work of Item No. 0010 are forthcoming and will be issued in a future amendment.

1.2.11 ITEM NO. 0011 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0011, All Work for Construction of REINFORCED HARDENED DRIVABLE TURF (RHDT), identified as an option on the drawings, payment of which shall constitute full compensation for Item No. 0011, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

Associated work that is part of Base Item 0001, and is not to be construed as part of Item No. 0011, includes but is not limited to the following:

All base and top course materials listed in Detail A, Sheet C-510, including satisfactory cohesionless materials below engineered aggregate base material, engineered aggregate base material, and topsoil, as well as the hydroseeding indicated on L-103.

1.2.12 ITEM NO. 0012 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0012, All Work for Construction of the LANDSCAPING AND IRRIGATION, identified as an option on the drawings, payment of which shall constitute full compensation for Item No. 0012, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

Associated work that is part of Base Item 0001, and is not to be construed as part of Item No. 0012, includes but is not limited to the following:

Soil preparation for entire site, mulch, seeding, stub out for irrigation system and all sleeving under pavement sections.

1.2.13 ITEM NO. 0013 (OPTION ITEM)

Payment will be made at the contract lump sum prices for Item No. 0013, All Work for Construction of COMMUNICATION DUCTS across the access loop road, to the south of the building, identified as an option on the drawings, payment of which shall constitute full compensation for Item No. 0013, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

This item includes but is not limited to the following: Ten (10) Communication Line Duct Assemblies in locations indicated on C-105, and as detailed in detail R-20 as shown on sheet C-508.

1.2.14 ITEM NO. 0014 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0014, All Work for Design and Construction of the Concrete Pad, PAD MOUNTED PROPANE TANK, and associated underground piping, valves and equipment to establish an alternate fuel source for the project, as specified, payment of which shall constitute full compensation for Item No. 0014, complete. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

Drawings and specifications describing the work of Item No. 0014 are forthcoming and will be issued in a future amendment.

1.2.15 ITEM NO. 0015 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0015, All Work for Design and Construction of a PRE-FABRICATED STEEL STORAGE BUILDING, Concrete Pad and Footings, as specified, payment of which shall constitute full compensation for Item No. 0015, complete. This storage structure is to replace the existing storage structure found on the Site and is to be installed at Ft. Lewis, Washington, in a location to be determined by the

Contracting Officer. Work includes all labor, materials, equipment and transportation, and other work as required to complete construction.

Drawings and specifications describing the work of Item No. 0015 are forthcoming and will be issued in a future amendment.

1.2.16 ITEM NO. 0016 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0016, Provide all supervision, personnel, equipment, transportation, material, and other items and services necessary to operate, service and maintain the Battle Simulation Center, Fort Lewis, Washington for the Second Year after completion of construction in accordance with the requirements specified in Technical Specification 01830 Operation and Maintenance, payment of which shall constitute full compensation for Item No. 0016, complete.

1.2.17 ITEM NO. 0017 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0017, Provide all supervision, personnel, equipment, transportation, material, and other items and services necessary to operate, service and maintain the Battle Simulation Center, Fort Lewis, Washington for the Third Year after completion of construction in accordance with the requirements specified in Technical Specification 01830 Operation and Maintenance, payment of which shall constitute full compensation for Item No. 0017, complete.

1.2.18 ITEM NO. 0018 (OPTION ITEM)

Payment will be made at the contract lump sum price for Item No. 0018, Provide all supervision, personnel, equipment, transportation, material, and other items and services necessary to operate, service and maintain the Battle Simulation Center, Fort Lewis, Washington for the Fourth Year after completion of construction in accordance with the requirements specified in Technical Specification 01830 Operation and Maintenance, payment of which shall constitute full compensation for Item No. 0018, complete.

1.2.19 ITEM NO. 0019 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0019, Provide all supervision, personnel, equipment, transportation, material, and other items and services necessary to operate, service and maintain the Battle Simulation Center, Fort Lewis, Washington for the Fifth Year after completion of construction in accordance with the requirements specified in Technical Specification 01830 Operation and Maintenance, payment of which shall constitute full compensation for Item No. 0019, complete.

1.3 PROGRESS PAYMENT INVOICE

1.3.1 Construction

During the construction phase of this contract, requests for payment shall be submitted in accordance with Federal Acquisition Regulations (FAR) Subpart 32.9, entitled "PROMPT PAYMENT", and Paragraphs 52.232-5 and 52.232-27, entitled "Payments Under Fixed-Price Construction Contracts", and "Prompt Payment for Construction Contracts", respectively. In

addition each request shall be submitted in the number of copies and to the designated billing office as shown in the Contract.

1.3.2 Operation and Maintenance

During the O&M phase of this contract, the Contractor will be paid for services ordered and accepted in accordance with the following contract clauses in SECTION 00700: Payments (FAR 52.232-1), Discounts for Prompt Payment (FAR 52.232-8), Limitations on Withholding of Payments (FAR 52.232-9), Extras (FAR 52.232-11), and Prompt Payment (FAR 52.232-25.

PARTS 2 and 3 NOT USED

PROGRESS PAYMENT INVOICE

See Federal Acquisition Regulations (FAR) 32.900, 52.232-5, & 52.232-27

1. PROJECT AND LOCATION	2. DATE
3. CONTRACTOR NAME AND ADDRESS (Must be the same as in the Contract)	4. CONTRACT NO. _____
	5. INVOICE NO. _____
6. DESCRIPTION OF WORK	7. PERIOD OF PERFORMANCE From: To:
8. DISCOUNT TERMS	
9. OFFICIAL TO WHOM PAYMENT IS TO BE FORWARDED Name: Title: Phone: () -	10. OFFICIAL TO BE NOTIFIED OF DEFECTIVE INVOICE Name: Title: Phone () -
11. CERTIFICATION: I hereby certify, to the best of my knowledge and belief, that (1) The amounts requested are only for the performance in accordance with the specifications, terms, and conditions of this contract; (2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of Chapter 39 of Title 31, United States Code; and (3) This request for progress payment does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.	
<div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 30%;">_____ (Signature)</div> <div style="width: 30%;">_____ (Title)</div> <div style="width: 30%;">_____ (Date)</div> </div>	
12. OTHER INFORMATION OR DOCUMENTATION required by Contract. Provide two (2) copies of each (check and attach if applicable): <input type="checkbox"/> Updated Progress Chart/Schedule <input type="checkbox"/> Progress Narrative <input type="checkbox"/> Certified Payrolls (submitted weekly) <input type="checkbox"/> Safety Exposure Report <input type="checkbox"/> Updated Submittal Register <input type="checkbox"/> Progress Photos <input type="checkbox"/> Subcontractor/Employee Listings	(FOR GOVERNMENT USE ONLY) Retainage: ____% Amt.: \$_____ Withholdings: \$_____ Reason: _____ _____ Following items are current: As-Builts ____ Yes ____ No O & M Manuals ____ Yes ____ No 1354 Data ____ Yes ____ No Submittal Register ____ Yes ____ No

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop

AASHTO T 224 (1996) Correction for Coarse Particles in the Soil Compaction Test

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregates

ASTM D 422 (1963; R 1998) Particle-Size Analysis of Soils

ASTM D 1140 (1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

ASTM D 1556 (1990; R 1996el) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))

ASTM D 2216 (1998) Laboratory Determination of Water (Moisture) Content of Soil, and Rock

ASTM D 2487 (1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922 (1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 (1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 5084	(1990; R 1997) Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

1.2 REFERENCED SPECIFICATION

By this reference, the Washington State Department of Transportation (WSDOT) Standard Specifications are hereby appended.

1.3 DEFINITIONS

1.3.1 Satisfactory Materials

Satisfactory materials for use beneath AC roadways, concrete slabs, PCC paving, Reinforced Hardened Driveable Turf, and other areas not defined as seeded, shall comprise any materials classified by ASTM D 2487 as GP, GP-GM, SP. Satisfactory materials for grading shall be comprised of stones less than 8 inches (200 mm), except for fill material for pavements and reinforced hardened driveable turf roadway, which shall be comprised of stones less than 3 inches (75 mm) in any dimension. Satisfactory material for use in backfilling areas to be seeded except for areas beneath the areas defined as Reinforced Hardened Driveable Turf shall also include GM.

1.3.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

1.3.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.3.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch (9.0 mm) sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch (9.0 mm) sieve shall be expressed as a percentage of the maximum density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224. To maintain the same

percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

1.3.5 Topsoil

Conform to requirements Sections 02921 SEEDING, 02922 SODDING, and 02924 REINFORCED HARDENED DRIVEABLE TURF.

1.3.6 Type I Liner Material

Type I Liner Material shall be silt and clay materials free from roots, organic matter, frozen material, debris, rocks, or any foreign material. Maximum in-place clod size shall be 1/2 inch (13 mm), thoroughly blended to provide homogeneous material relatively uniform in gradation and moisture content throughout.

a. Atterberg Limit:

1. Liquid limit between 30 and 50.
2. Plasticity index between 20 and 50.

b. Gradation: Material having 100 percent by weight passing 1 inch (25 mm) sieve, 80 percent by weight passing U.S. No. 4 sieve and at least 55 percent by weight passing U.S. No. 200 sieve.

c. Permeability: Maximum rate of 1.27×10^{-3} (cm/sec) and a minimum rate of 1.06×10^{-3} (1.8 inches/hour or 1.5 inches/hour, respectively) centimeters per second at relative compaction of between 90 and 95 percent.

1.3.7 Quarry Spalls

Quarry spalls shall meet the requirement of WSDOT Section 9-13.6.

1.3.8 Drain Rock

Drain rock shall consist of clean, rounded, durable rock ranging in size from 1 inch (25 mm) to 3/4 inch (19 mm) with 100 percent passing the 1-inch (25-mm) screen sieve and 50 to 70 percent passing 3/4-inch (19 mm) sieve, and zero percent passing the 1/2 inch (13 mm).

1.3.9 Flow Fill Backfill for Trench Backfill Use

Flow fill backfill shall be low-density mix of 45 lbs (30 kg/m³) of cement, 250 lbs (148 kg/m³) fly ash, a maximum water to cement ratio of 1.39, with a slump range of between 6 to 8 inches (150 to 200 mm).

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control and Assurance Plan for Type I Liner Material; G

SD-03 Product Data

Source Quality Control for Type I Liner Material; G

Procedure and location for proposed source of Type I Liner Material.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

SD-06 Test Reports

Testing; G.

Type I Liner Material Certified Test Results; G

Within 24 hours of conclusion of physical tests, 6 copies of test results, including calibration curves and results of calibration tests.

SD-07 Certificates

Testing; G.

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

1.5 SUBSURFACE DATA

Subsurface soil boring log locations are shown on the Civil Survey drawings and the log information is included on the General Drawings. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.6 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation. Excavation specified shall be done on a classified basis, in accordance with the following designations and classifications.

1.6.1 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation.

1.7 UTILIZATION OF EXCAVATED MATERIALS

~~Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated~~

~~waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.~~

Unsatisfactory materials removed from the excavation shall be disposed of off the base. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of off the base. Course rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow an any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

1.8 QUALITY CONTROL AND ASSURANCE PLAN FOR TYPE I LINER MATERIAL

- a. Identification and location of proposed borrow source(s).
- b. Source of water for compaction and permeability testing.
- c. Natural clay or soil mix processing, compaction, and moisture control equipment, to include following as appropriate for each equipment type:
 1. Manufacturer's name and address.
 2. Catalog and manufacturer data sheets.
 3. Equipment operating data from similar projects.
 4. Dimensions and weight.
- d. Moisture Control Plan: Method to prevent drying, cracking, saturation, or other damage prior to installation of permanent covering, if any.

1.9 SOURCE QUALITY CONTROL FOR TYPE I LINER MATERIAL

- a. Provide services of independent soils testing agency.
- b. General:
 1. Presence of any contaminants above acceptable limits will be reason to reject source, regardless of other test results.
 2. Do not deliver imported Type I Liner Material to site until materials tests have been accepted in writing by Contracting Officer.
 3. Obtain Samples taken across proposed source area, to proposed source depth, taking into account variability of soils within

source for tests that include gradation (sieve and hydrometer analysis, Atterberg Limits, natural moisture content, moisture-density relationship, molding moisture content and density, and permeability tests).

4. Perform tests as necessary to locate and confirm an acceptable source of imported material.
5. During construction conduct grain size, natural moisture content, Atterberg Limits, and moisture-density relationship tests on each 500 tons of material obtained from borrow source(s).
6. If tests conducted indicate that material does not meet specified requirements, terminate material placement until corrective measures are taken. Remove and replace material which does not conform to specified requirements.
7. Submit Type I Liner Material Certified Test Results to Contracting Officer.

c. Permeability Testing:

1. Prepare Samples taken from proposed borrow source by compacting test specimens to at least 92 percent relative compaction at moisture content within 5 percentage points above optimum moisture, as determined by ASTM D 1557.
2. Perform constant head triaxial permeability tests in accordance with ASTM D 5084, to measure permeability of compacted natural clay material.
 - a) Trim test specimens to length-to-diameter ratio of 0.5 to 1.3.
 - b) Sheath specimens in latex membrane, placed in triaxial cell, consolidated under an average effective confining pressure of 2 to 3 psi, subjected to back pressure sufficient to saturate specimen, and permeated under hydraulic gradient less than 30 across specimen.
 - c) Monitor inflow and outflow volumes and rates. Record time and flow data for at least 1 day beyond time when inflow rate equals outflow rate, at which time pressures may be relieved and physical measurements of specimens obtained for calculations.
3. Provide test data to Contracting Officer showing acceptable performance of tested material.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, or as meeting the Contractor's requirements, acceptable topsoil, as specified elsewhere, may be stripped and spread on areas already graded and prepared for topsoil, or transported and deposited

in stockpiles convenient to areas that are to receive application of the topsoil later. Acceptable topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches (50 mm) in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.2 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Complete excavation and removal from the site of unsatisfactory material shall occur full depth below existing ground elevations under building footprint below all AC or PCCP paved or Reinforced Hardened Driveable turfed roadways is required.

Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING.

Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of off the base. Unsatisfactory excavated material shall also be disposed of off the base. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times and conform to the Construction Phase Erosion Sedimentation Control Plan (ESC). Satisfactory material required for fill or embankment in excess of that produced by excavation within the grading limits shall be imported from approved offsite areas selected by the Contractor as specified.

The Contractor shall review the available geotechnical information and conform to the unsatisfactory materials removal, as specified above, in all respects.

3.2.1 Basins, Ditches, Gutters, and Channel Changes

Excavation of basins, ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of off the site or reused if acceptable. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work. Contractor shall make excavation to the subgrade elevation necessary to allow placement of Type I Liner Material where specified.

3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of

structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. ~~Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no~~ No borrow shall be obtained within the limits of the ~~project site without prior written approval~~base. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.4 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

3.5 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02630 STORM-DRAINAGE SYSTEM; and Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.6 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

3.6.1 General Requirements

Existing ground surface on which fill is to be placed but not under paved or turfed roads and all buildings shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 6 inches (150 mm); pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95

percent laboratory maximum density for cohesionless materials. Excavated ground surface on which fill is required to be placed in areas below building footprint or below areas where paved or turfed roadways are to be constructed shall be constructed of acceptable materials as defined in applicable portions of paragraph EMBANKMENTS.

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

3.6.2 Frozen Material

Embankment shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Contracting Officer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompact to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Embankment material shall not contain frozen clumps of soil, snow, or ice.

3.7 EMBANKMENTS

3.7.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches (75 mm). The material shall be placed in successive horizontal layers of loose material not more than 12 inches (305 millimeters) in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.8 SUBGRADE PREPARATION

3.8.1 Construction

Subgrades shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches (150 mm) below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 1/2 inch (15 millimeters) when tested with a 10-foot (3-meter) straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 1/2 inch (15 mm) from the established grade and cross section.

3.8.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, each layer of the embankment shall be compacted to at least 90 percent of laboratory maximum density.

3.8.2.1 Subgrade for Paved or Turf Pavements

Depth Below
Pavement (or
Shoulder)
Surface

Percentage of Laboratory Maximum Density Required

		Inches Fill		Inches Cut	
From	To	Cohesive Materials	Cohesionless Materials	Cohesive Materials	Cohesionless Materials
_____	_____	_____	_____	_____	_____

Subgrade for pavements shall be compacted to at least 95 percentage laboratory maximum density for the full depth of material below the surface of the pavements shown.

3.8.2.2 Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 95 percentage laboratory maximum density for the full depth of the shoulder.

3.9 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon

as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.10 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 0.1 foot (30 mm) of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

3.11 PLACING TOPSOIL

Conform to Specification Sections 02921 SEEDING, 02922 SODDING, and 02924 REINFORCED HARDENED DRIVEABLE TURF.

3.12 TYPE I LINER EQUIPMENT, PREPARATION, AND INSTALLATION

a. Processing Equipment:

1. Of type and sufficient size to process material to meet requirements for maximum clod size and to provide homogeneous blended material.
2. Consisting of rotovator, discs, or screens.

b. Compaction Equipment:

1. Use equipment that provides kneading action, such as wobble-wheeled roller, padfoot, or sheepsfoot roller.
2. Of suitable type and adequate to obtain densities specified.
3. To provide satisfactory breakdown of materials to form dense homogeneous fill free of visible voids.
4. Maintained and operated in condition that will deliver manufacturer's rated compactive effort.
5. Use sheepsfoot tine lengths that do not pull material up from finished surface.

6. If adequate densities are not obtained, provide additional larger, different types of equipment.

c. Moisture Control Equipment:

1. Use equipment for applying water of type and quality adequate for Work, that does not leak, and equipped with distributor bar or other device to assure uniform application.
2. Use equipment for mixing and drying out material consisting of blades, discs, or other equipment.

d. Subgrade Preparation:

1. Scarify, Excavate and Grade existing ground surface to meet designated grades beneath Clay Barrier layer.
2. Compact subgrade below barrier layer to 90 percent relative density.
3. Install nonwoven geotextile.

e. Installation:

1. Place material after preparation of subgrade in maximum loose 6-inch (152 mm) lifts.
2. Rotovator:
 - a) Use to condition each lift of material prior to compaction.
 - b) Break down so that 90 percent of soil clumps are 3-inch (75-mm) maximum size.
 - c) Use if required to make moisture content uniform throughout lift, as determined by field testing.
 - d) Make as many passes as necessary to achieve specified results.
3. Compact Type I Liner Material to minimum density of 92 percent relative compaction at a moisture content between the optimum as determined by ASTM D 1557, and 6 percentage points above optimum. Overlap joints between adjacent placement areas at least 5 feet (1.5 m). Scarify surface of each lift with rotovator to depth of 2 inches (50 mm) prior to placing subsequent lift of material. Within 24 hours of placement of material, place temporary protective cover of plastic sheeting over exposed areas.
4. Exposed Surfaces: Compact to protect liner material from moisture changes, loss, or gain. If liner material becomes cracked or becomes softened due to moisture changes, scarify full depth of lift with rotovator, adjust moisture content to that specified below, and recompact as previously specified.

5. Surface of Final Lift: Free from tine or roller marks, holes, depressions more than 1-inch (25 mm) deep, or protrusions extending above surface more than 1-inch (25 mm).

3.13 MOISTURE CONTROL

Implement Moisture Control Plan. During compacting operations, maintain moisture content in each lift of material within 6 percentage points above optimum moisture as determined by ASTM D 1557. If too dry, add water to material by sprinkling fill, then mixing to make moisture content uniform throughout lift. If too wet, aerate material by blading, discing, harrowing, or other methods, to hasten drying process. Construct material limits within tolerance of 0.5 feet (150 mm) horizontal and 0.1-foot (30 mm) vertical, except where shown or specified.

3.14 TESTING

Testing shall be performed by an approved commercial testing laboratory. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompact to meet specification requirements. Tests on recompact areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.14.1 Fill and Backfill Material Gradation

One test per 500 cubic yards (382 cubic meters) stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136, ASTM D 422, and ASTM D 1140, as required.

3.14.2 In-Place Densities

- a. One test per 2,400 square feet (223 square meters), or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

- b. One test per 100 square feet (9.3 square meters,) or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
- c. One test per 100 linear feet (9.3 linear meters), or fraction thereof, of each lift of embankment or backfill for roads.

3.14.3 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

- a. One check test per lift for each 2,400 square feet (223 square meters,) or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each 100 square feet (9.29 square meters), of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each 250 linear feet (76.2 linear meters), or fraction thereof, of embankment or backfill for roads.

3.14.4 Field Quality Control for Type I Liner Material

a. Field Density and Moisture Content Tests:

- 1. Perform at frequency of one test for each test fill pad and for each 5,000 square feet of clay lift placement.
- 2. Determine in-place density and moisture content by any one or combination of following methods: ASTM D 2922, ASTM D 3017, ASTM D 1556, ASTM D 2216, or other methods acceptable to ENGINEER. If nuclear gauge method (ASTM D 2922) is used to determine in-place density, moisture content readings shall be calibrated for clay with at least two oven-dried moisture content tests each day.
- 3. If compaction tests indicate density or moisture content is not as specified, terminate material placement and take corrective action prior to continuing placement.

3.14.5 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.14.6 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 250 cubic yards (191.2 cubic meters) of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.14.7 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.15 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

-- End of Section --

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SECTION 02924

REINFORCED HARDENED DRIVEABLE TURF

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

TURFGRASS PRODUCERS INTERNATIONAL (TPI)

ASPA GSS (1988) Guideline Specifications for Sodding

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4355 (1992) Deterioration of Geotextiles from
Exposure to Ultraviolet Light and Water
(Xenon-Arc Type Apparatus)

ASTM D 4427 (1992; R 1996) Peat Samples by Laboratory
Testing

ASTM D 4595 (1986; R 1994) Tensile Properties of
Geotextiles by the Wide-Width Strip Method

GEOSYNTHETIC INSTITUTE (GSI)

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act (1995) Federal Seed Act Regulations Part 201

DOA SSIR (April 1984) Soil Survey Investigation Report
No. 1, Soil Survey Laboratory Methods and
Procedures for Collecting Soil Samples, Soil
Conservation Service

1.2 DEFINITIONS

1.2.1 Stand of Reinforced Hardened Driveable Turf (RHDT)

95 percent ground cover of the established species.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal
Procedures."

SD-03 Product Data

All Reinforced Hardened Driveable Turf System Data

Manufacturer's literature including physical characteristics, application and installation instructions for equipment, surface erosion control material and chemical treatment material.

A listing of equipment to be used for the seeding operation.

Delivery

Delivery schedule.

Topsoil

Availability of topsoil, if any, from the stripping and stock piling operation.

Seed Establishment Period

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

Maintenance Record; G

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide; G

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-06 Test Reports

Topsoil Composition Tests; G

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Sod
Seed; G
Topsoil; G
pH Adjuster
Fertilizer
Soil Conditioners
Pesticide; G

Finished Grade and Topsoil

Finished grade status.

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.
- b. Topsoil. Particle size determined by sieve analysis, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.
- d. Fertilizer. Chemical analysis and composition percent.
- e. Organic Material: Composition and source.
- f. Soil Conditioner: Composition and source.
- g. Mulch: Composition and source.
- h. Asphalt Adhesive: Composition.
- i. Pesticide. EPA registration number and registered uses.
- j. Contractor's Certificate that the finished grade and topsoil placement meet project requirements.

1.4 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 For Sod Protection, a delivery schedule shall be developed and shown on the project schedule and updated monthly as construction is ongoing..

Protect delivered sod from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer, Gypsum, Sulfur, Iron, and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulphur, iron, and lime may be furnished in bulk with certificate indicating the above information.

1.5.1.3 Delivered Topsoil

Prior to the delivery of topsoil, its availability shall be verified in conformance with Section 02921, SEEDING.

1.5.2 Storage

1.5.2.1 Sod Storage

Lightly sprinkle with water, cover with moist burlap, straw, or other approved covering; and protect from exposure to wind and direct sunlight until planted. Provide covering that will allow air to circulate so that internal heat will not develop. Do not store sod longer than 24 hours. Do not store directly on concrete or bituminous surfaces.

1.5.2.2 Seed, Fertilizer, Sulfur, Iron, and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.3 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.4 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit (32 degrees Celsius).

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

1.7.2 Sod

Place sod a maximum of thirty six hours after initial harvesting, in accordance with ASPA GSS as modified herein.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-approved seed or sod stock of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content,

and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer. Should sod be used with specified seed mixture conform to Table ~~2.1.2~~ 2.1.1 and article TIME LIMITATIONS.

2.1.2 Composition

Table 2.1.1
Low-Growing Turf Seed Mix

	% Weight	% Purity	% Germination
Dwarf tall fescue (several varieties) <i>Festuca arundinacea</i> var.	45	98	90
Dwarf perennial rye (Barclay) <i>Lolium perenne</i> var. <i>barclay</i>	30	98	90
Red fescue <i>Festuca rubra</i>	20	98	90
Colonial bentgrass <i>agrostis tenuis</i>	5	98	90

NOTE: For application weight of seed specified conform to Section 02921, Paragraph 3.3.2, 5 pounds per 1,000 square feet.

2.1.3 Seed Planting Seasons

FOR TIDEWATER, VIRGINIA, OR NORTH CAROLINA

Planting Dates

<u>Season 1</u>	<u>Season 2</u>	<u>Season 3</u>
MAY 15 to JUL 15	AUG 15 to OCT 02	OCT 6 to APR 30

SEED QUANTITY

2 lbs/1000 sq. ft.	12 lbs/1000 sq. ft.	6 lbs/1000 sq. ft.
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SEED MIXTURE

<u>Planting Season</u>	<u>Variety</u>	<u>% Weight</u>
Season 1	Common Bermuda (Hulled)	100
Season 2	Fescue (Ky31)	50
	Common Bermuda (Unhulled)	50
Season 3	Annual Rye	100

FOR PUERTO RICO

Planting Dates

<u>Location</u>	<u>Spring</u>	<u>Fall</u>
Puerto Rico	There are no specific planting dates. However, best results are obtained with spring planting.	

FOR ICELAND

Planting Dates

<u>Location</u>	<u>Summer</u>	<u>Fall</u>
Iceland	May thru August	

Seed Quantity

<u>Location</u>	<u>All Seasons</u>
Puerto Rico	2 lbs/1000 sq ft
Iceland	8 lbs/1000 sq ft

Seed Mixture

<u>Location</u>	<u>Planting Season</u>	<u>Variety</u>	<u>Percent Weight</u>
Puerto Rico	Year round	Common Bermuda	100
Iceland	Summer	Creeping Red Fescue	80
		Perennial Rye Grass	20
Planting of seed shall occur between April 1 through June 30, and September 1 through October.			

2.2 SOD

2.2.1 Classification

Field grown, certified as classified in the ASPA GSS. Machine cut sod at a uniform thickness of 3/4 inch (19 mm) within a tolerance of 1/4 inch (6 mm), excluding top growth and thatch. Each individual sod piece shall be strong enough to support its own weight when lifted by the ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will be rejected. After sod has been harvested and prior to delivery to site, each piece of sod shall be processed using a high pressure hydraulic washing with water leaving no soil or substrate attached to the roots.

2.2.2 Composition

Conform to Table [2.1.22.1.1.](#)

2.2.3 Sodding Seasons

Sodding may occur at any time within temperature ranges and ground conditions stipulated.

2.3 TOPSOIL

Topsoil shall be provided from one of three sources.

2.3.1 Existing Soil

Modify existing soil to conform to the requirements specified in paragraph entitled "Composition."

2.3.2 On-Site Stripped and Salvaged Topsoil

Reusable surface soil stripped and stockpiled on site if requirements specified for Topsoil in paragraph entitled "Composition" are met.

2.3.3 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional Topsoil shall be furnished by the Contractor.

2.3.4 Topsoil Composition

Containing from 5 to 8 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR. Maximum particle size, 3/4 inch (19 mm), with maximum 3 percent retained on 1/4 inch (6.35 mm) screen and a minimum of 5 percent passing through a 120 mesh screen. Other components shall be within the following requirements:

Topsoil shall be sandy loam, sandy clay loam, loam, clay loam, silty clay loam or silt loam soil as described by USDA textural class. Topsoil shall contain 5-20 percent by volume of mixed, composted, fine-particle organic matter. Topsoil shall be obtained from well drained areas and shall not contain more than 5 percent water by volume. The topsoil shall be free from debris, noxious weeds, rhizomes, roots, toxic substances or any other material that may be harmful to plant growth. Decomposed wood derivatives (ground bark, sawdust or other wood waste) used in the topsoil shall be free of weeds, weed seeds and sticks and fully decomposed a minimum of 6 months or stabilized with nitrogen. The pH shall be between 5.5 and 7.5. Soluble salts shall not exceed 500 ppm. Each delivery shall be accompanied by a guaranteed statement of analysis listing the percent of organic matter and the pH.

2.4 PH ADJUSTER

2.4.1 Lime

To be determined by Contractor testing and evaluation by the local Agriculture County Extension Service Office to determine the required percentages of carbonates, calcium, and magnesium for the project area.

<u>Location</u>	<u>Percent Carbonates</u>	<u>Percent Calcium</u>	<u>Percent Magnesium</u>
Tidewater, VA	94	80	14
North Carolina	94	52	42

Puerto Rico No lime required. Delete this paragraph

2.4.2 Sulfur

100 percent elemental. Proportion to be added to topsoil as determined from Topsoil Testing similar to Section Lime.

2.4.3 Iron

100 percent elemental. Proportion to be added to topsoil as determined from Topsoil Testing similar to Section Lime.

2.5 SOIL CONDITIONERS

Provide singly or in combination as required to meet specified requirements for topsoil. Soil conditioners shall be nontoxic to plants.

2.5.1 Peat

Sphagnum moss peat derived from a freshwater site and conforming to ASTM D 4427 as modified herein. Shred and granulate peat to pass 1/2 inch (13 mm) mesh screen and condition in storage pile for minimum 6 months after excavation.

2.5.2 Sand

Clean and free of materials harmful to plants.

2.5.3 Rotted Manure

Composted, horse or cattle manure containing maximum 25 percent by volume of straw, or other bedding materials. Manure shall be free of stones, sticks, and soil, viable weed seed, and other materials harmful to plants.

2.5.4 Composted Derivatives

Ground bark, nitrolized sawdust, humus, or other wood green waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.5.4.1 Particle Size

Minimum percent by weight passing:

No. 4 (4.75 mm) mesh screen	95
No. 8 (2.36 mm) mesh screen	80

2.5.4.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.5.5 Calcined Clay

Granular particles produced from montmorillonite clay calcined to minimum temperature of 1200 degrees F (650 degrees C) to the following gradation: minimum 90 percent passing 8 mesh (2.36 mm) screen, 99 percent retained on 60 mesh (250 micrometers) screen and, maximum 2 percent passing 100 mesh (150 micrometers) screen. Bulk density: 40 pounds maximum per cubic foot (650 kg maximum per cubic meter).

2.5.6 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 91 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through a No. 20 (850 micrometers) mesh screen, 100 percent passing through a No. 16 (1.18 mm) mesh screen.

2.6 FERTILIZER

2.6.1 Controlled Release Fertilizer

Nitrogen-phosphorous-potassium ration of 10-4-6 plus 2 percent iron, composed of pills coated with plastic resin to provide continuous release of fertilizer for at least 6 months.

2.7 SURFACE TOPDRESSING

<u>Location</u>	<u>Mulch Type</u>
Tidewater, Virginia	Grain straw or wood fiber
North Carolina	Grain straw or wood fiber
Puerto Rico	Dry hay

Free from, noxious weeds, mold, and other deleterious materials.

2.7.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment.

2.8 PESTICIDE

Conform to Section 02921 SEEDING, and Section 02922 SODDING, Article 2.5 and 2.6, respectively, Pesticide.

2.9 WATER

Source of water to be approved by Contracting Officer, suitable quality for irrigation.

2.10 ENGINEERED AGGREGATE BASE MATERIAL

2.10.1 Engineered Aggregate Base Material

Engineered aggregate base material shall conform to Section 02722, AGGREGATE AND/OR GRADED CRUSHED AGGREGATE BASE COURSE and conform to all of Article 2.1, AGGREGATES, except Table I.

2.10.1.1 Gradation

Gradation shall conform to AASHTO No. 5 shown in Table Aggregate Portion and as further modified.

<u>1-1/2-Inch</u> <u>(37.5-mm)</u>	<u>1-Inch</u> <u>(25-mm)</u>	<u>3/4-Inch</u> <u>(19-mm)</u>	<u>1/2-Inch</u> <u>(12.5-mm)</u>	<u>3/8-Inch</u> <u>(9.5-mm)</u>
100 Percent Passing	90 - 100 Percent Passing	20 - 55 Percent Passing	0 -10 Percent Passing	0 - 5 Percent Passing

2.10.1.2 Gradation Modifications

The aggregate portion shall have a D50 of 1/2 inch (12.5 mm). The percentage of void space when compacted shall be at least 30 percent. Topsoil, as defined herein the Specification, shall be added and blended to produce a homogeneous mixture for placement.

2.11 REINFORCED HARDENED DRIVEABLE TURF GEOTEXTILE FABRIC

Reinforced Hardened Driveable Turf Geotextile Fabric shall conform to Section 02373, GEOTEXTILE, Table 1, RHDT.

2.12 GEOGRID SUPPORT

Geogrid shall be a geosynthetic manufactured for reinforcement applications. The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill materials. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. The geogrid shall be manufactured with 100 percent virgin resin consisting of polyethylene, polypropylene, polyester, or other approved material and with a maximum of 5 percent in-plant regrind material. Polyester resin shall have a minimum molecular weight of 25,000 and a carboxyl end group number less than 30. Polyethylene and polypropylene shall be stabilized with long term antioxidants.

2.12.1 Geogrid Properties

The reinforcement shown on the contract drawings shall meet the property requirements listed in Table 1. Reinforcement strength requirements represent minimum average roll values in the machine direction.

TABLE 1

PROPERTY	REQUIREMENT	TEST DESIGNATION
Weight	7.0	
UV Resistance	70 percent after 500 hours	ASTM D 4355
Aperture Size, inch (mm)	0.8 (22)	

Open Area, %	75+	
Wide Width Tensile Strength, lb/ft		
@ Ultimate MD	2600	ASTM D 4595
CMD	1350	
@ 5% Strain MD	1100	

2.12.2 Splices

Splices shall consist of a standard method or device recommended by the manufacturer of the geogrid. Splices shall be at least 12-inch (305 mm). Splicing may consist of overlaps, fusion wedge welding, sewing, or bodkin connections.

2.13 REINFORCED HARDENED DRIVEABLE TURF SUPPORT GRID ASSEMBLY

RHDT support grid assembly shall be constructed of 100 percent polyethylene with up to 50 percent being recycled material, black in color with at least 1.5 percent carbon black. The support grid assembly shall be designed to have a Unit Minimal Crush Strength of 420 psi (2,900 kPa) at 70 degrees F (21 degrees C), with a Material Flexural Modulus of 35,000 psi (240,000 kPa) measured at 73 degrees F (23 degrees C). The Support Grid System grids shall be 5 square feet (1 meter square) nominal, +1-15 percent, have a minimum of 2-inch (50-mm) depth, have open bottom cells of at least 9 sq in (0.0563 sq m) with at least 40 percent open space and have load transfer attachment and alignment clips to interlock with adjacent grids. The units shall be designed specifically for use with reinforced turf as outline in this Specification.

PART 3 EXECUTION

3.1 SCHEDULE

Develop and provide for a review of a proposed schedule of work activities showing overall approach, product delivery schedule, methods to employ, conformance with seed establishment period, and work location conforming to all specified criteria herein.

3.2 PREPARATION

3.2.1 EXTENT OF WORK

Provide excavation, shaping, leveling, engineered aggregate base material installation and compaction, turf support grid installation with topsoil fill, soil preparation, fertilizing, seeding, finished grade and topsoil certification acceptance and surface topdressing of all newly graded areas designated for construction of reinforced hardened driveable turf..

3.2.2 Engineered Aggregate Base Compaction Curve Development

The Engineered Aggregate Base mix requirements, as previously stipulated, will require the development of a final compaction effort equivalent to a final California Bearing Ratio (CBR) of 7 at a certain Optimum Moisture

Content (OMC) plus or minus 2 percentage points. Perform the necessary testing of the Engineered Aggregate Base to determine the following:

- a. Develop grain size distribution curve and using the Unified Soils Classification System, classify soil by type and plastic index whether soil is cohesionless or cohesive.
- b. Develop density-moisture curve and determine if soil mix is swelling or non-swelling.
- c. Develop point of maximum dry density. Allowable compaction range is 5 percent.
- d. From the data developed, determine compaction effort and density that yields a minimum CBR of 7.

3.2.3 RHDT Installation Preparation

Remove existing soil to the depth shown on the site sections and bring the subgrade to the Engineered Aggregate Subbase elevation with noncohesive acceptable soil. After areas have been brought to finish subgrade elevation, thoroughly till to minimum depth of 6 inches (150 mm) by scarifying, disking, harrowing, or other methods approved by the Contracting Officer. Remove debris and stones larger than 4 inches (100 mm) in any dimension remaining on surface after tillage and compact to a density of 95 percent of maximum density.

3.2.3.1 Engineered Aggregate Installation

Provide and install Engineered Aggregate Base Material and construct base section to specified elevations, cross-slopes, and CBR equivalent density.

3.2.3.2 Support Grid Assembly

Install Support Grid Assembly in accordance with details. Provide and install necessary additional supporting geotextile fabric or geogrid system below support Grid Assembly at joints where load bearing connections are displaced or removed due to geometric placement of the assembly. No grid assembly may be installed with any dimension less than 12 inches (305 mm).

- a. Roll Support Grid Assembly areas to adjust any vertical misalignment. The entire area shall be firmed and leveled with a roller system. Contractor shall develop approach to level rolling system by wetting or drying supporting engineered aggregate material or using vibratory or non-vibratory equipment as conditions dictate.

3.2.3.3 Topsoil Installation for Seeding

Provide approved topsoil to meet necessary finish grade. After areas have been brought to indicated finish grade, if seeding, incorporate fertilizer, pH adjusters, soil conditioners into soil a minimum depth of 2 inches (50 mm) by raking or other method approved by the Contracting Officer. Remove debris and stones larger than 1 inch (25 mm) in any dimension remaining on the surface after tillage.

3.2.3.4 Topsoil Installation for Sodding

Install approved topsoil containing all fertilizer, pH adjusters, and soil to a depth necessary for the installation of sod blanks if sodding method is chosen. Lightly compact topsoil by vibratory plate compactor or other means, and perform rolling if necessary to achieve the regular finish grade necessary.

3.2.3.5 Final Grade

Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.2.3.6 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

Synthetic Fertilizer 90 pounds per acre (100.9 kg per hectare).

3.3 SEEDING

3.3.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil surface to a loose consistency and fill any low areas approximately 1/4 inch (6 mm) above top of Support Grid Assembly and moisten soil to a depth of 6 inches (150 mm). Do not seed when ground is muddy, frozen, snow covered, or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.3.2 Seed Application Method

3.3.2.1 Broadcast and Drop Seeding

Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/2 inch (13 mm) in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.3.2.2 Hydroseeding

First, mix water, tackifier, and fiber. Fiber shall be added at 1,500 pounds, dry weight, per acre (16.8 kg per 100 square meter). Then add and mix seed, tackifier at 3 percent, and fertilizer to produce a homogeneous slurry. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.3.3 Surface Topdressing for Seeding

Spread top dressing over seed bed area to an even depth of 1/2 inch (13 mm). Take precautionary measures to prevent topdressing materials from spilling onto pavements, utilities structures, or planter beds.

3.3.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds (134 kg per m) for each foot of roller width.

3.3.5 Erosion Control Material

Install in accordance with manufacturer's instructions.

3.3.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 6 inches (150 mm) without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3.7 Application of Pesticide

Conform to Section 02921 SEEDING, Article 3.6, APPLICATION OF PESTICIDE, in all respects or Section 02922 SODDING, Article 3.6, APPLICATION OF PESTICIDE, as the method of installation dictates.

3.4 SODDING

3.4.1 Scheduling and Preparation

Place sod a maximum of 36 hours after initial harvesting, in accordance with ASPA GSS as modified herein. Thoroughly moisten areas to be sodded immediately prior to placing sod. Adjust topsoil depth in RHDT Support Grid Assembly to ensure that when sod blank is pressed into cavity, and all adjacent cavities as the size of the sod blank dictates, the bottom of the sod reaches the top of the top soil layer and once firmly installed and compacted the sod "soil layer" is elevated at least 1/4 inch (6 mm) but no more than 1/2 inch (13 mm) above the top of the Support Grid.

3.4.2 Sodding

Cut sod into workable blanks square or rectangular in shape. Place individual blanks of sod over the Support Grid assembly cavities and then by wetting to loosen the sod/soil matrix and by applying foot pressure, press firmly into cavity by foot pressure or by tamping. When sod is installed, roll entire area to smooth. Install sand, uncompacted, in any small low areas to bring to finish grade.

3.4.3 Finishing

After completing sodding, blend edges of sodded area smoothly into surrounding area.

3.4.4 Watering

Start watering areas sodded as required by daily temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to minimum depth of 6 inches (150 mm).

3.5 PROTECTION OF REINFORCED HARDENED DRIVEABLE TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.6 MAINTENANCE RECORD

Conform to Section 02921 SEEDING, Article 3.9, SEED ESTABLISHMENT PERIOD, in all respects, or Section 02922 SODDING, Article 3.9 SOD ESTABLISHMENT PERIOD, as the method of installation dictates.

-- End of Section --

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SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD	(1995a) Quality Certification Program Description
AISC Design Guide No. 10	(1989) Erection Bracing of Low-Rise Structural Steel Frames
AISC M013	(1983) Detailing for Steel Construction
AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
AISC M016	(1989) ASD Manual of Steel Construction
AISC M017	(1992; Errata 1994) Connections
AISC M018L	(1995) LRFD Manual of Steel Construction Volume I
AISC M019L	(1995) LRFD Manual of Steel Construction Volume II
AISC S303	(1992) Steel Buildings and Bridges
AISC S334L	(1988) Load and Resistance Factor Design Specifications for Structural Joints Using ASTM A325 or A490 Bolts
AISC S340	(1992) Metric Properties of Structural Shapes with Dimensions According to ASTM A6M
AISC S341	(1992) Seismic Provisions for Structural Steel Buildings
AISC S342L	(1993) Load and Resistance Factor Design Specification for Structural Steel Buildings

ASME INTERNATIONAL (ASME)

ASME B46.1	(1995) Surface Texture, (Surface Roughness, Waviness, and Lay)
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M	(1998a) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A36/A36M	(1997; Rev. A) Carbon Structural Steel
ASTM A53/A53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A108	(1999) Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A307	(1997) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A325M	(1997) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A490M	(1993) Heat-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A490	(1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	(1997) Carbon and Alloy Steel Nuts
ASTM A563M	(2001) Carbon and Alloy Steel Nuts (Metric)
ASTM A572/A572M	(2001) High-Strength Low-Alloy Columbium-Vanadium of Structural Steel
ASTM A992/A992M	(1998e1) Steel for Structural Shapes for Use in Building Framing
ASTM F436M	(1993) Hardened Steel Washers (Metric)
ASTM F436	(1993) Hardened Steel Washers
ASTM F844	(1998) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F959M	(1999; Rev. A) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners (Metric)
ASTM F959	(1999; Rev. A) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

ASTM F1554	(1999) Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F1852	(2000) "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2002) Structural Welding Code - Steel
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STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 6	(1994) Commercial Blast Cleaning
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC PA 1	(1991) Shop, Field, and Maintenance Painting
SSPC PS 13.01	(1991) Epoxy-Polyamide Painting System

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC M018L and AISC M019L except as modified in this contract.

1.3 MODIFICATIONS TO REFERENCES

In AISC M018L and AISC M019L, AISC S342L, AISC S303, AISC S334L, and AISC S340, except as modified in this section, shall be considered a part of AISC M018L and AISC M019L and is referred to in this section as AISC M018L and AISC M019L.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection plan, including description of temporary supports; G

Fabrication drawings, including description and detailing of connections; G

SD-03 Product Data

Shop primer; G

Load indicator washers

Include test report for Class B primer.

SD-06 Test Reports

Structural Steel; G

Class B coating; G

Fasteners (Bolts, nuts, and washers); G

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Structural Steel; G

Fasteners (Bolts, nuts, and washers); G

Shop primer

AISC Quality Certification; G

Welding procedures and qualifications; G

1.5 AISC QUALITY CERTIFICATION

Work shall be fabricated in an AISC certified Category Cbd fabrication plant. ~~Erection shall be performed by AISC certified steel erector (CSE).~~

1.6 SEISMIC PROVISIONS

In addition to AISC M018L and AISC M019L, the structural steel system shall be provided in accordance with AISC S341.

1.7 QUALITY ASSURANCE

1.7.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC M013, AISC M016 and AISC M017. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS standard welding symbols.

1.7.2 Certifications

1.7.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing, and a detailed sequence of welding, including each welding procedure required.

1.7.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months. See Section 05090, WELDING, STRUCTURAL.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel

ASTM A36/A36M for plates, rolled shapes (except wide flange W-shapes), and bars except where specifically noted otherwise.

2.1.2 High-Strength Structural Steel

ASTM A992/A992M, Grade 50, for all wide flange (W or WF) shapes. ASTM A572/A572M, Grade 50, for all steel column base plates and for other plates specifically noted on the Drawings.

2.1.3 Hollow Structural Sections (HSS)

ASTM A500, Grade B ($F_y = 46$ ksi) for all square or rectangular hollow structural sections (HSS). ASTM A500, Grade B ($F_y = 42$ ksi) for all round hollow structural sections (HSS).

2.1.4 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.2 FASTENERS (BOLTS, NUTS, AND WASHERS)

2.2.1 Anchor Bolts and Nuts

Anchor bolts shall conform to ASTM F1554, Grade 55 (380 MPa) with weld supplement S1, heavy hex nut per paragraph 2.6 and ASTM F436 washer, except where specifically noted otherwise.

2.2.2 High-Strength Bolts

High-strength bolts shall conform to ASTM A325 (ASTM A325M) or ASTM A490 (ASTM A490M), bolt type 1, plain uncoated. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications. Bolt

length and thread length shall be as required for the connection type shown with hardened washers as required.

2.2.3 Carbon Steel Bolts and Nuts

Carbon steel bolts shall conform to ASTM A307, Grade A. Carbon steel nuts shall conform to ASTM A563 (ASTM A563M), Grade A, heavy hex style.

2.2.4 Washers

ASTM F844 washers for ASTM A307 bolts, and ASTM F436 (ASTM F436M) washers for ASTM A325 (ASTM A325M) and ASTM A490 (ASTM A490M) bolts. Hardened washers shall conform to ASTM F436.

2.2.5 Slip Critical (SC) High-Strength Bolts

All slip critical (SC) bolts shall use tension control bolts conforming to ASTM A325 and ASTM F1852 unless specifically noted otherwise.

2.2.6 Load Indicator Washers

ASTM F959 (ASTM F959M).

2.2.7 Welded Shear Connectors

Welded shear connectors shall be headed anchor studs (HAS) or threaded anchor studs (TAS) as shown on the Drawings and shall conform to ASTM A108, Standard Quality Grades 1010 through 1020, inclusive either semi-killed or killed aluminum or silicon dioxidation.

2.3 SHOP PRIMER

SSPC Paint 25, (alkyd primer) or SSPC PS 13.01 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC M016 and AISC M017 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC FCD for Category Cbd structural steelwork. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inches (13 micrometer) as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

3.1.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

3.1.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, surfaces to receive sprayed-on fireproofing, surfaces designed as part of a composite steel concrete section, or surfaces within 3 inches (76 mm) of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F (7 degrees C or over 35 degrees C); or when the primer may be exposed to temperatures below 40 degrees F (4 degrees C) within 48 hours after application, unless approved otherwise by the Contracting Officer.

3.1.3 Cleaning

SSPC SP 6, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

3.1.4 Primer

Apply primer to a minimum dry film thickness of 2.0 mil (0.05 mm) except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

3.2 ERECTION

- b. Erection of structural steel shall conform to AISC S303 and in accordance with AISC Design Guide No. 10.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.2.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.3 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with AISC S342L. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque

wrenches. Punch, subpunch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.3.1 Carbon Grade Bolts and High-Strength Bearing Type Bolts

A307 bolts and A325N bearing type bolts (ASTM A325/ASTM A325M) shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.3.2 High-Strength Slip Critical (SC) Bolts

Slip critical (SC) bolts conforming to ASTM A325 (ASTM A325M) shall be tightened using direct tension indicators or using tension control "twist off" type bolts installed and tested in accordance with manufacturer's recommendations. Slip critical bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

3.3.2.1 Installation of Load Indicator Washers (LIW)

ASTM F959 (ASTM F959M). Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F436 (ASTM F436M) washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening. In addition to the LIW, provide flat ASTM F436 (ASTM F436M) washers under both the bolt head and nut when ASTM A490 (ASTM A490M) bolts are used.

3.3.2.2 Welded Shear Connectors

Welded shear connectors shall be welded and installed in accordance with manufacturer's recommendations.

3.4 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.4.1 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.5 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of weld inspection.

3.5.1 Welds

Minimum preheat requirements shall conform to AWS D1.1. For inspection of welded connections, see Section 05090, WELDING, STRUCTURAL.

3.5.2 Load Indicator Washers

3.5.2.1 Load Indicator Washer Compression

Load indicator washers shall be tested in place to verify that they have been compressed sufficiently to provide the 0.015 inch (0.38 mm) gap when the load indicator washer is placed under the bolt head and the nut is tightened, and to provide the 0.005 inch (0.13 mm) gap when the load indicator washer is placed under the turned element, as required by ASTM F959 (ASTM F959M).

3.5.2.2 Load Indicator Gaps

In addition to the above testing, an independent testing agency as approved by the Contracting Officer, shall test in place the load indicator gapson 20 percent of the installed load indicator washers to verify that the ASTM F959 (ASTM F959M) load indicator gaps have been achieved. If more than 10 percent of the load indicators tested have not been compressed sufficiently to provide the average gaps required by ASTM F959 (ASTM F959M), then all in place load indicator washers shall be tested to verify that the ASTM F959 (ASTM F959M) load indicator gaps have been achieved. Test locations shall be selected by the Contracting Officer.

3.5.3 High-Strength Bolts

3.5.3.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in AISC S334L, Table 4, depending on bolt size and grade. The bolt tension shall be developed by tightening the nut. A representative of the manufacturer or supplier shall be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements.

3.5.3.2 Inspection

Inspection procedures shall be in accordance with AISC S334L, Section 9. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

3.5.3.3 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension

requirements. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations shall be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, shall be tested. Retest new bolts after installation.

3.6 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum
Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3 (1992) Ladders - Fixed - Safety Requirements

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M (2001) Zinc (Hot-Dip Galvanized) Coatings on
Iron and Steel Products

ASTM A 36/A 36M (2000a) Carbon Structural Steel

ASTM A 500 (1999) Cold-Formed Welded and Seamless Carbon
Steel Structural Tubing in Rounds and Shapes

ASTM A 53/A 53M (2001) Pipe, Steel, Black and Hot-Dipped,
Zinc-Coated, Welded and Seamless

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized)
or Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel Sheet,
Metallic-Coated by the Hot-Dip Process

ASTM E 814 (2000) Fire Tests of Through-Penetration Fire
Stops

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1998) Minimum Design Loads for Buildings and
Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2000) Structural Welding Code - Steel

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(1994) Metal Bar Grating Manual
NAAMM MBG 532	(1994) Heavy Duty Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(1998; Errata 10-98-1) Portable Fire Extinguishers
NFPA 211	(2000) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-344	(Rev B) Lacquer, Clear Gloss, Exterior, Interior
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Miscellaneous Metal Items; G.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. The applicable erection drawings shall be submitted with all detail cutsheets submittals.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water. Complete handrail and guardrail assemblies and the post base connection and anchorage system shall be capable of withstanding loads as specified in ASCE 7.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have standard mill finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 16 gauge (1.52 mm) steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 14 by 20 inches (350 by

500 mm) and of not lighter than 14 gauge (1.9 mm) steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall have a shop applied prime coat.

~~2.2 CORNER GUARDS AND SHIELDS~~

~~Corner guards and shields for jambs and sills of openings and edges of platforms shall be steel shapes and plates anchored in masonry or concrete with welded steel straps or end weld stud anchors. Corner guards for use with glazed or ceramic tile finish on walls shall be formed of 0.0625 inch (1.6 mm) thick stainless steel with satin finish, shall extend 5 feet (1.5 m) above the top of cove base or to the top of the wainscot, whichever is less, and shall be securely anchored to the supporting wall.~~

~~2.3~~ 2 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53/A 53M, Type E or S, weight STD, black finish.

~~2.4~~ 3 DOWNSPOUT BOOTS

Downspout boots shall be cast iron with receiving bells sized to fit downspouts.

~~2.5~~ 4 FLOOR GRATINGS AND FRAMES

Carbon steel grating shall be designed in accordance with NAAMM MBG 531 and NAAMM MBG 532 to meet the indicated load requirements. Edges shall be banded with bars 1/4 inch (6 mm) less in height than bearing bars for grating sizes above 3/4 inch (19 mm). Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating. Floor gratings and frames shall be galvanized after fabrication.

~~2.6~~ 5 HANDRAILS

Handrails shall be designed to resist a concentrated load of 200 pounds (890 N) in any direction at any point of the top of the rail or 20 pounds per foot (292 Newtons per meter) applied horizontally to top of the rail, whichever is more severe.

~~2.6~~5.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A 53/A 53M or structural tubing conforming to ASTM A 500, Grade A or B of equivalent strength. Unless otherwise noted on Drawings, steel railings shall be 1-1/2 inch (40 mm) nominal size. Railings systems located interior of the building shall be shop painted and railing systems located exterior of the building shall be hot-dip galvanized.

Maximum post spacing shall be 5 foot (1520 mm) horizontal spacing unless specifically noted otherwise on the Drawings.

- a. Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 6 inches (150 mm) long.

(2) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

- b. Removable sections, toe-boards, and brackets shall be provided as indicated.

~~2.7~~—6 LADDERS

Ladders shall be galvanized steel, fixed rail type in accordance with ANSI A14.3.

~~2.8~~—7 MIRROR FRAMES

Frames for plate glass mirrors larger than 18 by 30 inches (450 by 750 mm) shall be fabricated from corrosion-resisting steel with satin finish. Frames shall be provided with concealed fittings and tamperproof mountings.

~~2.9~~—8 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

~~2.10~~—9 ROLL-UP FLOOR MATS; WM-3

Roll-up mats shall be of aluminum construction with carpet inserts as shown on the Drawings. Roll-up mats shall be for use in recessed areas. Colors and patterns shall be as specified in Section 09915 COLOR SCHEDULE.

~~2.11~~—10 SAFETY NOSING

Safety nosings shall be of cast aluminum with cross-hatched, abrasive surface. Nosing shall be 3 inches (75 mm) wide and terminating at not more than 6 inches (150 mm) from the ends of treads, except nosing for metal pan cement-filled treads shall extend the full length of the tread. Safety nosings shall be provided with anchors not less than 3/4 inch (19 mm) long. Integrally cast mushroom anchors are not acceptable.

~~2.12~~—11 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, grating treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to ASTM A 36/A 36M. Stairs and accessories shall be shop painted. Risers on stairs with metal pan treads shall be deformed to form a sanitary cove to retain the tread concrete. Integral nosings shall have braces extended into the concrete fill. Gratings for treads and landings shall conform to NAAMM MBG 531. Grating treads shall have slip-resistant nosings.

~~2.13~~—FIRE EXTINGUISHER CABINETS

~~Cabinets to be located in fire-rated walls shall be fire-rated type, fabricated in accordance with ASTM E 814, and shall be listed by an approved testing agency for 1- and 2-hour combustible and non-combustible wall systems. The testing agency's seal shall be affixed to each fire-rated cabinet. Cabinets shall be of the recessed type suitable for 2-1/2 gallon (10 kg) extinguishers. Box and trim shall be of heavy gage rolled steel. Door shall be a rigid frame with full length piano type hinge and double strength (DSA) glass panel. Door and panel shall have the manufacturer's standard white baked enamel finish inside and out.~~

2.14—12 METAL TRIM, MTL-1

Metal trim for wall and ceiling paneling shall be extruded aluminum, of profiles as shown in drawings, and colors in accordance with Section 09915 COLOR SCHEDULE.

2.15—13 METAL TELEPHONE ENCLOSURES

Telephone enclosures to be of perforated stainless steel over acoustical material, dimensions as shown in drawings and color in accordance with Section 09915 COLOR SCHEDULE. Coordinate with public telephone units.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 12 by 12 inches (300 by 300 mm) shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.3 INSTALLATION OF CHIMNEYS, VENTS, AND SMOKESTACKS

Chimneys and vents shall be installed in accordance with NFPA 211. A cleanout opening with a tight-fitting, hinged, cast-iron door and frame shall be provided at the base of each smokestack. A top band shall be provided on stacks for attachment of painter's rigging. Roof housing, rain cap, downdraft diverter, fire damper, and other accessories required for a complete installation shall be provided. Sections of prefabricated lined stacks shall be joined with acid-resisting high-temperature cement and steel draw bands. Means to prevent accumulation of water in the smokestack shall be provided.

3.4 INSTALLATION OF PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete having a compressive strength of 3000 psi (21 MPa) minimum.

3.5 INSTALLATION OF DOWNSPOUT BOOTS

Downspouts shall be secured to building through integral lips with appropriate fasteners.

3.6 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.6.1 Installation of Steel Handrails

Unless otherwise shown on Drawings, steel handrail installation shall be by means of base plates bolted to stringers or structural steel framework. Rail ends shall be secured by steel pipe flanges through-bolted to a back plate or by 1/4 inch (6 mm) lag bolts to studs or solid backing.

3.7 ERECTION OF GUY CABLES

Guy cables shall be erected as indicated. Anchor rods shall be cast in concrete located and reinforced as shown.

3.8 INSTALLATION OF METAL GRID WALKWAYS

Walkways shall be installed after final flood coat and aggregate surfacing. Each stand shall be set on a protective pad; the pad may be adhesively attached to the bottom of the stand or set loose under the stand. The area where the supports are to be located shall be swept clear of loose aggregate. Protective pad shall be placed on the roof membrane except on inverted roofs where the protective pad shall be set on the rigid insulation.

3.9 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

3.10 TRENCH FRAMES AND COVERS

Trench frames and covers shall finish flush with the floor.

3.11 INSTALLATION OF FIRE EXTINGUISHER CABINETS

Metal fire extinguisher cabinets shall be furnished and installed in accordance with NFPA 10 where shown on the drawings or specified.

-- End of Section --

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SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2898	(1994; R 1999) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM F 547	(1977; R 1995) Definitions of Terms Relating to Nails for Use with Wood and Wood-Based Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C20	(1999) Structural Lumber Fire-Retardant Pressure Treatment
AWPA C27	(1999) Plywood - Fire-Retardant Pressure Treatment
AWPA C9	(1997) Plywood - Preservative Treatment by Pressure Processes
AWPA P5	(2000) Standards for Waterborne Preservatives

FOREST STEWARDSHIP COUNCIL (FSC)

FSC 1.2	(2000) FSC Principles and Criteria of Forest Stewardship
FSC 5.3.5	(2003) Forests Certified by FSC - Accredited Certification Bodies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Finish Carpentry; G, RO

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-04 Samples

Moldings; G, RO

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS VENEER PANELS, SIDING, AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), by using recycled wood products and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Wood products shall be from sustainable forests as certified by the Forest Stewardship Council (FSC 1.2 and FSC 5.3.3). Wood products shall contain no added urea formaldehyde resins.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, wood structural panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.1.4 Preservative Treatment

2.1.1.4.1 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 0.25 pcf (4 kg per cubic meter) intended for above ground use.
- b. 0.4 pcf (6.4 kg per cubic meter) intended for ground contact and fresh water use.

2.1.1.5 Fire-Retardant Treatment

Fire-retardant treated lumber shall be pressure treated in accordance with AWPA C20. Fire-retardant treated plywood shall be pressure treated in accordance with AWPA C27. Material use shall be defined in AWPA C20 and AWPA C27 for Interior Type A and Exterior Type. Treatment and performance inspection shall be by a qualified independent testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance with such rating. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D 2898, Method A, prior to being tested for compliance with AWPA C20 or AWPA C27. Items to be treated include all items in roofing system, in contact with concrete or within 6" of gravel.

~~2.1.1.6 Epoxy Aggregate Panels~~

~~Prefinished epoxy aggregate panels shall consist of an asbestos-free cement board base sheet with a factory applied surface of epoxy resins and decorative natural stone chips. Factory applied finish shall be a minimum of 20 mils (0.5 mm) of 100 percent solids, two-component epoxy resin-based coating followed by an application of inert aggregate. Stone color shall be selected from manufacturer's standard colors. Cement board base sheet shall be a minimum of 1/4 inch (6 mm) thick. Finished panels shall be dimensionally stable. Water absorption on the surfaced side shall not exceed 0.20 percent after 24 hours of submergence in water. Accessories shall be manufacturer's standard extruded matching color aluminum moldings. Moldings shall be provided for meeting strips, end caps, inside corners, or outside corners. Fasteners shall be noncorrosive, self-tapping screw type and finished to match the color of stone. Caulking compound shall be color compatible, low modulus silicone or urethane type.~~

~~2.1.1.7~~ 6 Moldings

Moldings shall be of the pattern indicated and shall be of a grade compatible with the finish specified.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches (40 mm) into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 EXECUTION

3.1 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

3.2 TABLES

TABLE I. SPECIES AND GRADE TABLES

Grading
Rules

Species

NELMA Grading Rules

Maple - "character" grade

-- End of Section --

SECTION 07214

BOARD AND BLOCK INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 203	(1992) Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C 272	(1991; R 1996) Water Absorption of Core Materials for Structural Sandwich Constructions
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 930	(1992) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 1621	(1994) Compressive Properties of Rigid Cellular Plastics
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 154	(1988; R 1993) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-03 Product Data

Block or board insulation; G

Protection board or coating

Accessories

SD-08 Manufacturer's Instructions

Block or Board Insulation

Adhesive

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials to the site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.3.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.4 SAFETY PRECAUTIONS

1.4.1 Other Safety Considerations

Consider safety concerns and measures as outlined in ASTM C 930.

PART 2 PRODUCTS

2.1 BLOCK OR BOARD INSULATION

Provide only thermal insulating materials recommended by manufacturer for type of application indicated. Provide board or block thermal insulation conforming to the following standards and the physical properties listed below:

- a. Cellular Glass: ASTM C 552
- b. Extruded Preformed Cellular Polystyrene: ASTM C 578

2.1.1 Thermal Resistance

As indicated or R-11 minimum.

2.1.2 Other Material Properties

Provide thermal insulating materials with the following properties:

- a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than 20 pounds per square inch (psi) (170 kilopascals (kPa)) when measured according to ASTM D 1621.
- b. Flexural strength: Not less than 25 psi (275 kPa) when measured according to ASTM C 203.
- c. Water Vapor Permeance: Not more than 1.1 Perms (6.3×10^{-8} g/Pa.s.m²) or less when measured according to ASTM E 96, desiccant method, in the thickness required to provide the specified thermal resistance, including facings, if any.

- d. Water Absorption: Not more than 2 percent by total immersion, by volume, when measured according to ASTM C 272.

2.1.3 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum required recycled material contents (by weight, not volume) are:

Polyisocyanurate/Polyurethane:	9 percent
Phenolic Rigid Foam :	5 percent
Perlite Board:	23 percent

2.1.4 Prohibited Materials

Do not provide materials containing more than one percent of asbestos.

2.2 VAPOR RETARDER AND DAMPPROOFING

2.2.1 Dampproofing for Masonry Cavity Walls

Bituminous material is specified in Section 07110, "Bituminous Dampproofing."

2.2.2 Vapor Retarder under Floor Slab

- a. Water vapor permeance: 0.2 Perm (1.14×10^{-8} g/Pa.s.m²) or less when tested in accordance with ASTM E 96.
- b. Puncture resistance: Maximum load no less than 40 pounds (18 kilograms) when tested according to ASTM E 154.

2.3 PROTECTION BOARD OR COATING

As recommended by insulation manufacturer.

2.4 ACCESSORIES

2.4.1 Adhesive

As recommended by insulation manufacturer.

2.4.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that all areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If installing perimeter or under slab insulation, check that the fill is flat, smooth, dry, and well tamped. If moisture or other conditions are found that do not

allow the proper installation of the insulation, do not proceed but notify the Contracting Officer of such conditions.

3.2 INSTALLATION

3.2.1 Insulation Board

Install and handle insulation in accordance with the manufacturer's installation instructions. Keep material dry and free of extraneous materials. Observe safe work practices.

3.2.2 Continuity of Insulation

Butt tightly against adjoining boards and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating any thermal bridges or voids.

3.3 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to exterior walls or slab edges in slab-on-grade or floating-slab construction.

3.3.1 Manufacturer's Instructions

Install, attach, tape edges, provide vapor retarder and other requirements such as protection against vermin, insects, damage during construction as recommended in manufacturer's instructions.

3.3.2 Insulation on Vertical Surfaces

Install thermal insulation on exterior of foundation walls on grade beams partially below grade and on edges of slabs on grade. Fasten insulation with adhesive or mechanical fasteners.

3.3.3 Insulation Under Slab

Provide insulation horizontally under slab on grade for a distance of ~~6-2~~ feet (~~1828.8mm~~610mm) from the edge of slab. Turn insulation up at slab edge, and extend full height of slab. Install insulation on top of vapor retarder and turn retarder up over the outside edge of insulation to top of slab.

3.3.4 Protection of Insulation

Protect insulation on vertical surfaces from damage during construction and back filling by application of protection board or coating. Do not leave installed vertical insulation unprotected overnight. Install protection over entire exposed exterior insulation board.

3.4 VAPOR RETARDER

Apply a continuous vapor retarder as indicated. Overlap all joints at least 6 inches (150 mm) and seal with pressure sensitive tape. Seal at sill, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

-- End of Section --

SECTION 07530

ELASTOMERIC ROOFING (EPDM)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4637 (1996) EPDM Sheet Used in Single-Ply Roof Membrane

ASTM E 108 (1996) Fire Tests of Roof Coverings

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P9513 (1996) Loss Prevention Data for Roofing Contractors

UNDERWRITERS LABORATORIES (UL)

UL 580 (1994; Rev thru Feb 1998) Tests for Uplift Resistance of Roof Assemblies

UL 790 (1997; Rev thru Jul 1998) Tests for Fire Resistance of Roof Covering Materials

UL 1256 (1998) Fire Test of Roof Deck Constructions

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing System; G RO

Drawings showing size of sheets, position of sheets and splices, flashing details, fastening patterns where applicable for insulation and membrane sheets, and expansion joint details. Detail showing construction of water cutoffs to be used at membrane terminations at the end of a day's work to seal the roofing system from water intrusion.

SD-03 Product Data

Installation; G RO

Manufacturer's instructions for preparing and installing the membrane, flashings, seams, insulation, nailers and other accessories.

Protection of Finished Roofing

Protection plan showing areas to be protected, type of material used; a plan to protect the membrane from damage until completion of work by other trades, and a description of the method of repairing the roofing.

Inspection

The inspection procedure for substrate suitability including decks, curbs and insulation installation, prior to start of the work. Inspection procedures during and after placement of the membrane, and after completion of work by other trades.

SD-07 Certificates

Materials

Certificates of compliance attesting that the roofing system and materials meet specification requirements. The certificates shall list the components required for the specified fire and wind uplift resistance ratings.

1.3 GENERAL REQUIREMENTS

Elastomeric membrane roofing shall be mechanically fastened to the roof surfaces indicated. Roofing membrane sheet widths shall be consistent with membrane attachment methods and wind uplift requirements, and shall be as large as practical to minimize joints. Membrane shall be free of defects and foreign material. Flashing work shall be coordinated to permit continuous membrane installation operations. Applied insulation shall be weatherproofed by the membrane on the same day.

1.3.1 Delivery and Storage

Materials shall be delivered to the jobsite in the manufacturer's original, unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents. Materials other than ballast shall be stored in clean, dry areas. Storage temperatures shall be as specified by the manufacturer. Materials other than ballast stored on the roof shall not exceed one day's supply and shall be distributed so as not to exceed the roof live load capacity. Ballast shall be stored uncovered, shall not be in contact with sod or earth, and shall not be stored on the roof.

1.3.2 Fire Resistance

The completed roof system shall have a ASTM E 108 (same test as UL 790 and FM P9513, Appendix A) Class A classification, and meet fire test requirements of UL 1256 or FM P9513, Appendix B for roof deck construction. Compliance of each component of the roofing system shall be evidenced by label or by written certification from the manufacturer.

1.3.3 Wind Uplift Requirements

Mechanically attached roofing systems shall have a 120 UL 580 Class Rating or FM P9513, Appendix C Windstorm Classification. Ratings from other independent laboratories may be substituted provided that the tests, requirements and ratings are documented to be equivalent, to the satisfaction of the Contracting Officer.

1.3.4 Warranty

Manufacturer's standard warranty for the roofing system shall be provided for not less than 10 years from acceptance of the work. Warranty shall state that manufacturer shall repair or replace defective materials if the roofing system leaks or allows the insulation beneath the membrane to become wet during the period of the warranty.

PART 2 PRODUCTS

2.1 ADHESIVES

Adhesives, splicing cements, solvents, and sealants shall be as recommended by the membrane manufacturer.

2.2 FASTENERS

Fasteners for sheet-metal flashing shall be corrosion resistant steel annular-type nails or screws. Fasteners for anchoring the roofing membrane shall be as approved by the membrane manufacturer and identical to those used to obtain the wind uplift rating.

2.3 FLASHING

Flashing shall be of ultra-violet resistant materials as recommended by the membrane manufacturer. Prefabricated shaped flashings shall be used where possible. Sheared edges of metal flashings that contact the membrane shall be turned into a tight hem.

2.4 MEMBRANE

Membrane shall conform to ASTM D 4637, Type I EPDM, Grade 1; Class U, 0.060 inch (1.52 mm) minimum thickness.

2.5 PREFABRICATED ACCESSORIES

Pipe seals and expansion joint covers shall be types and sizes recommended by the membrane manufacturer.

2.6 EPDM WALKWAYS

Walkways shall be manufacturer's recommended walk surface a minimum of twice the thickness of the underlying membrane. Walkways shall be minimum of 36" (91 cm) wide and shall be continuous roll walkways. Walkways shall be a contrasting color to base roofing membrane.

2.7 PRE-CAST PAVER WALKWAYS

Precast concrete blocks, sized as indicated, without sharp edges and projections, and weighing no more than 80 lbs (36 kg) each. Pavers to be 18" x 18" x 41-5/8" (457 mm x 457 mm x 25-41 mm)

PART 3 EXECUTION

3.1 ENVIRONMENTAL CONDITIONS

Membrane shall not be installed in high wind, inclement weather or when there is visible ice, frost or moisture on the deck, insulation or membrane. Membrane shall not be installed when air temperature is below the minimum specified by the membrane manufacturer.

3.2 PREPARATION

The substrate of any bay or section of the building shall be complete and suitable for insulation and membrane installation before roofing is begun. Roofing on lightweight insulating concrete shall not be scheduled until the concrete passes the air-dry density test specified in Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE. Insulation over which elastomeric roofing is installed shall conform to Section 07220 ROOF INSULATION. Surfaces against which membrane is applied shall be smooth, clean, and free from dirt, water, dew, oil, grease, sharp edges and construction debris; all joints over 1/4 inch (6 mm) wide shall be sealed; joints over 1/2 inch (13 mm) between insulation boards shall be filled with the same insulation. Wood nailers shall comply with Section 06100 ROUGH CARPENTRY.

3.3 INSTALLATION

Installation shall comply with the manufacturer's approved instructions, except as otherwise specified.

3.3.1 Flashing

Edges of membrane, projections through the roof and changes in roof planes shall be flashed. The flashing material shall be extended and sealed a minimum of 3 inches (75 mm) on each side of the fasteners which attach the membrane to nailers. The installed flashing shall be fastened at the top of the flashing a maximum of 12 inches (300 mm) on center under metal counter-flashing or cap.

3.3.2 Expansion Joints

Expansion joints shall be covered using prefabricated covers or elastomeric flashing in accordance with the manufacturer's recommendations.

3.3.3 Membrane Installation

Membrane shall be applied in accordance with the manufacturer's instructions and the following requirements. Adjoining sheets comprising the membrane shall be adhered one to another using a butyl-based contact adhesive. Minimum width of the laps shall be 3 in (75 mm). A primer shall be used before applying the contact adhesive if required by the membrane manufacturer. In applying the contact adhesive, the minimum thickness of the wet film shall be in accordance with the membrane manufacturer's recommendations. If manufacturer's recommendations are not available, the minimum thickness shall be 0.025 inch (0.6 mm). A wet film thickness gage

shall be used to determine wet film thickness. Direction of lap shall be such that water flows over lap. Membrane joints shall be free of wrinkles or fishmouths. Before application of the contact adhesive, the rubber surfaces to be mated shall be well cleaned. Joints shall be inspected over entire length after completion and defective areas shall be resealed and patched. Damaged areas of membrane shall be removed and replaced with new materials, lapping underlying membrane by at least 3 inches (75 mm) on all sides.

3.3.4 Cutoffs

Cutoffs shall be installed if work day is ended or interrupted by bad weather before roof section is complete. The insulation line shall be straightened using loose-laid cut insulation and the membrane shall be sealed to the roof deck. Flutes in metal decking shall be sealed off along the cutoff edge. Membrane shall be pulled free or cut to expose the insulation when resuming work, and cut insulation sheets used for fill-in shall be removed as necessary to maintain the staggered pattern.

3.3.5 Installation of Walkways

EPDM Walkways shall be installed per manufacturer's recommendation for adhering to membrane. Install precast concrete paver block, where indicated. Provide an additional EPDM sheet under precast concrete paver blocks to protect roofing unless EPDM sheet manufacturer recommends otherwise. Install precast pavers on pedestals. Pedestals to be adjustable in 1/8" (3 mm) increments. Surface of pavers to be level.

3.4 PROTECTION OF FINISHED ROOFING

The roofing membrane shall be protected from damage by other trades. After completion of work by other trades, the protection shall be removed and the roof shall be inspected. Any damage shall be repaired in accordance with the recommendations of the roofing manufacturer.

3.5 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed elastomeric roofing with the contract requirements. The procedure shall include a checklist of points to be observed. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of roofing workers; start and end time of various tasks; condition of substrate.
- b. Verification of compliance of materials before, during and after installation.
- c. Inspection of insulation, nailers, flashings, penetrations and work requiring coordination with roofing.
- d. Inspection of membrane placement, splicing, and attachment.
- e. Inspection of placement of ballast and walkways.

03015/AE/11
Battle Simulation Center, Ft. Lewis, Wa.

f. Verification of ballast weight.

-- End of Section --

SECTION 10522

FIRE EXTINGUISHER CABINETS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM-01 (1988) Metal Finishes Manual for
Architectural and Metal Products

NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 101 (1997) Life Safety Code

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 1 (1982) Solvent Cleaning

SSPC SP 5 (1985) White Metal Blast Cleaning

SSPC SP 8 (1982) Pickling

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fire Extinguisher Cabinet; G RO
~~Fire Extinguisher; G RO~~

Product data for each type of product specified. For fire extinguisher cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style and materials.

~~1.3 QUALITY ASSURANCE~~

~~Coordinate with Contracting Officer to verify that fire extinguisher cabinets are sized to accommodate fire extinguishers provided by Government of type and capacity indicated.~~

PART 2 PRODUCTS

2.1 MOUNTING BRACKETS

- a. Provide brackets in plated finish designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated.
- b. Provide brackets for extinguishers located in cabinets and for those not located in cabinets, as indicated in the drawings or as required.

2.2 FIRE EXTINGUISHER CABINETS

Construction: Manufacturer's standard enameled steel box, with trim, frame, door, and hardware of type and style as follows:

Cabinet Type:	For semi-recessed installation in concrete masonry unit or steel stud/gypsum board walls as shown on drawings; 4" maximum total extension beyond finish wall surface
Trim Style:	One piece steel with corners mitered, welded and ground smooth
Door Construction:	Manufacturer's standard flat metal or clear acrylic fully glazed door with metal edge reinforcing at hinge and latch jambs
Door Hardware:	Either lever handle with cam action latch or door pull, exposed or concealed, and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees

2.3 FINISHES FOR FIRE EXTINGUISHER CABINETS, GENERAL

- a. Comply with NAAMM-01 "Metal Finishes Manual" for recommendations relative to application and designation of finishes.
- b. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment.

2.4 STEEL FIRE EXTINGUISHER CABINET FINISH

2.4.1 Surface Preparation

Solvent-clean surfaces in compliance with SSPC SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel in compliance with SSPC SP 5 (White Metal Blast Cleaning) or SSPC SP 8 (Pickling).

2.4.2 Baked Enamel Finish

Immediately after cleaning and pretreatment, apply manufacturer's standard two-coat baked enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 2.0 mils. Cabinet

interior shall be high gloss white color. Cabinet exterior color shall match adjacent wall.

~~2.5 FIRE EXTINGUISHERS~~

~~Provide type and size extinguishers as required by the Buckley AFB Fire Department.~~

PART 3 EXECUTION

3.1 INSTALLATION

- a. Install fire extinguisher cabinets and mounting brackets in accordance with NFPA 101 Life Safety Code in locations and indicated on the drawings at heights.
- b. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim, and to comply with manufacturer's instructions.
- c. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
- d. Install fire extinguishers in cabinets.

-- End of Section --

03015/AE/11

Battle Simulation Center, Ft. Lewis, Wa.

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 410 (1991) Forced-Circulation Air-Cooling and Air-Heating Coils

ARI 430 (1999) Central-Station Air-Handling Units

ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M (2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM C 916 (1985; R 1996e1) Adhesives for Duct Thermal Insulation

ASTM C 1071 (2000) Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

ASTM E 84 (2001) Surface Burning Characteristics of Building Materials

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.1 (1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

ASHRAE 70 (1991) Method of Testing for Rating the Performance of Air Outlets and Inlets

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (1999) Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds	(1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible
SMACNA Install Fire Damp HVAC	(1992; 2th Printing 1996) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
SMACNA Leakage Test Mnl	(1985; 6th Printing 1997) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL 181	(1996; Rev thru Dec 1998) Factory-Made Air Ducts and Air Connectors
UL 214	(1997; Rev thru Aug 2001) Tests for Flame- Propagation of Fabrics and Films
UL 555	(1999; Rev thru Jan 2002) Fire Dampers
UL 723	(1996; Rev thru Sep 2001) Test for Surface Burning Characteristics of Building Materials
UL Bld Mat Dir	(1999) Building Materials Directory
UL Elec Const Dir	(2001) Electrical Construction Equipment Directory
UL Fire Resist Dir	(2001) Fire Resistance Directory (2 Vol.)

1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.4 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G
Installation; G

Drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-03 Product Data

Components and Equipment; G

Manufacturer's catalog data included with the detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

- a. Piping Components
- b. Ductwork Components
- c. Air Systems Equipment
- d. Air Handling Units
- e. Terminal Units

Ductwork Leak Test Procedures; G

Pamper Acceptance Test

Proposed test procedures for ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

Diagrams; G

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Manufacturer's Experience; G

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Performance Tests; G

Proposed test schedules for hydrostatic test of piping, ductwork leak test, and performance tests, at least 2 weeks prior to the start of related testing.

Field Training; G

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-06 Test Reports

Performance Tests; G

Testing, Adjusting, and Balancing; G

Test reports for the piping hydrostatic test, ductwork leak test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year manufacturer's experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year

field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate installed by the manufacturer that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.5 DUCTWORK COMPONENTS

2.5.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA HVAC Duct Const Stds unless otherwise specified. Under no conditions shall DUCTWORK thinner than 26 ga be allowed on this project. Elbows shall be radius type with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. All return, exhaust, and supply ductwork downstream of the VAV boxes shall be constructed to a pressure class of 2-inch w.g. (Class 500 pa) and shall meet the requirements of seal class C. All supply ductwork from the air handlers to the VAV terminal boxes shall be constructed to 6-inch w.g. (Class 1500) and shall meet the requirements of seal class A. Sealants shall conform to fire hazard classification specified in THERMAL INSULATION FOR MECHANICAL SYSTEMS and shall be suitable for the range of air distribution and ambient temperatures that it will be exposed to. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA HVAC Duct Const Stds. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch (50 mm) band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

2.5.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.5.1.2 Insulated Nonmetallic Flexible Duct Runouts

Flexible duct runouts shall be used only where indicated. Runout length shall be as shown on the drawings, but shall in no case exceed 3 feet (1 m). Runouts shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Where coil induction or high velocity units are supplied with vertical air inlets, a streamlined and vaned and mitered elbow transition piece shall be provided for connection to the flexible duct or hose. The last elbow to these units, other than the vertical air inlet type, shall be a die-stamped elbow and not a flexible connector. Insulated flexible connectors may be used as runouts. The insulated material and vapor barrier shall conform to the requirements of Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. The insulation material surface shall not be exposed to the air stream.

2.5.1.3 General Service Duct Connectors

A flexible duct connector approximately 6 inches (150 mm) in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.5.1.4 High Temperature Service Duct Connections

Material shall be approximately 3/32 inch (2.38 mm) thick, 35 to 40-ounce per square yard (1.2 to 1.36 kg per square meter) weight, plain weave fibrous glass cloth with, nickel/chrome wire reinforcement for service in excess of 1200 degrees F (650 degrees C).

2.5.2 Ductwork Accessories

2.5.2.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA HVAC Duct Const Stds. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 x 18 inches (375 x 450 mm), unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 x 24 inches (600 x 600 mm) or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.5.2.2 Smoke/Fire Dampers

a. Ratings:

1. Fire Resistance: 1-1/2 hours in accordance with UL555.
2. Smoke Rating: Leakage Class I Smoke Damper in accordance with UL555S. A Class I smoke damper leaks no more than 8 cubic feet per minute (.23 m³/min) at 4 in. wg. (1 kPa) differential pressure. Damper shall be rated for vertical or horizontal applications.
3. Air Flow Rating: 2000 fpm/610 (M/min).

b. Construction:

1. Frame: 5 inches x minimum 16 gage (127 x minimum 1.6 mm) roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gage (2.3 mm) U-channel type frame.
2. Blades:
 - a) Style: True airfoil-shaped, single piece, double skin.
 - b) Action: Opposed.
 - c) Orientation: Horizontal.
 - d) Material: Minimum 14 gage (2.0 mm) equivalent thickness, galvanized steel.
 - e) Width: Maximum 6 inches (152 mm).
3. Bearings: Self-lubricating stainless steel sleeve, turning in extruded hole in frame.
4. Seals:
 - a) Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450 degrees F (232 degrees C) and galvanized steel for flame seal to 1,900 degrees F (1,038 degrees C). Mechanically attached to blade edge (glue-on or grip type seals are not acceptable).
 - b) Jamb: Stainless steel, flexible metal compression type.
5. Linkage: Concealed in frame.
6. Axles: Minimum 1/2 inch (13) diameter plated steel, hex-shaped, mechanically attached to blade.
7. Temperature Release Device: Heat-Actuated, Quick Detect.
 - a) Close (in a controlled manner) and lock damper during test, smoke detection, power failure, or fire conditions through actuator closure spring. At no time shall actuator disengage from damper blades.

b) Allow damper to be automatically and remotely reset after test or power failure conditions. After exposure to high temperature or fire, inspect damper before reset to ensure proper operation.

c) Controlled closing and locking of damper in 7 to 15 seconds to allow duct pressure to equalize. Instantaneous closure is not acceptable.

8. Release Temperature:

a) 165 degrees F (74 degrees C).

9. Actuator: Electric 120 V, 60 Hz, two-position, fail close. With external mounting.

10. Duct Transition Connection: Provide duct transition as required.

c. Accessories:

1. Duct Smoke Detector: Provide a factory mounted duct smoke detector completely wired into the damper assembly. The duct smoke detector shall be capable of detecting smoke in the ductwork from 0-2000 FPM. The detector shall utilize the Ionization method for smoke detection.

2. Mounting Angles: Provide factory fabricated mounting angles. The exact configuration is the contractor choice.

3. Factory Sleeve:

a) Minimum 16 gage (1.0 mm) thickness, minimum 17 inches (432 mm) long.

b) Silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.

d. Source Quality Controls:

a. Factory Tests: Factory cycle damper and actuator assembly to assure proper operation.

2.5.2.3 Fire Dampers

Fire dampers shall be 1-1/2 hour fire rated unless otherwise indicated. Fire dampers shall conform to the requirements of NFPA 90A and UL 555. Fire dampers shall be automatic operating type and shall have a dynamic rating suitable for the maximum air velocity and pressure differential to which it will be subjected. Fire dampers shall be approved for the specific application, and shall be installed according to their listing. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, will not impair the operation of the damper. Sleeves or frames shall be equipped with perimeter mounting angles attached on both sides of the wall or floor opening. Ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies

shall be constructed in conformance with UL Fire Resist Dir. Fire dampers shall be curtain type with damper blades out of the air stream. Dampers shall not reduce the duct or the air transfer opening cross-sectional area. Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.5.2.4 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch (5 mm) rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 8 inches (200 mm). Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches (300 mm). Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.5.2.5 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

2.5.3 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.5.3.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 15 inches (375 mm) in diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches (375 mm) in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge (1.0 mm) galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53/A 53M, Schedule 20 shall be used. Sleeve shall provide 1 inch (25 mm) clearance between the duct and the sleeve or 1 inch (25 mm) clearance between the insulation and the sleeve for insulated ducts.

2.5.3.2 Framed Prepared Openings

Openings shall have 1 inch (25 mm) clearance between the duct and the opening or 1 inch (25 mm) clearance between the insulation and the opening for insulated ducts.

2.5.3.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches (100 mm) wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 15 inches (375 mm) in diameter or less shall be fabricated from 20 gauge (1.0 mm) galvanized steel. Collars for round ducts larger than 15 inches (375 mm) and square, and rectangular ducts shall be fabricated from 18 gauge (1.3 mm) galvanized steel. Collars shall be installed with fasteners on maximum 6 inch (150 mm) centers, except that not less than 4 fasteners shall be used.

2.5.4 Sound Attenuation Equipment

a. Acoustical Duct Liner:

Acoustical duct lining shall be fibrous glass designed exclusively for lining ductwork and shall conform to the requirements of ASTM C 1071, Type I and II. Liner composition may be uniform density, graduated density, or dual density, as standard with the manufacturer. Lining shall be coated, not less than 1 inch (25 mm) thick. Where acoustical duct liner is used, liner or combination of liner and insulation applied to the exterior of the ductwork shall be the thermal equivalent of the insulation specified in THERMAL INSULATION FOR MECHANICAL SYSTEMS. Duct sizes shown shall be increased to compensate for the thickness of the lining used. In lieu of sheet metal duct with field-applied acoustical lining, acoustically equivalent lengths of fibrous glass duct or factory fabricated double-walled internally insulated duct with perforated liner may be provided. Net

insertion loss value, static pressure drop, and air flow velocity capacity data shall be certified by a nationally recognized independent acoustical laboratory.

2.5.5 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm (0.25 m/s) in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet (2 m) above the floor, they shall be protected by a grille or screen according to NFPA 90A.

2.5.5.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL Elec Const Dir for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

2.5.5.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches (150 mm) below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches (150 mm) above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.5.6 Air Vents, Penthouses, and Goosenecks

Air vents, penthouses, and goosenecks shall be fabricated from galvanized steel sheets with galvanized structural shapes. Sheet metal thickness, reinforcement, and fabrication shall conform to SMACNA HVAC Duct Const Stds.

Louver blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Air vents, penthouses, and goosenecks shall be provided with bird screen.

2.6 AIR SYSTEMS EQUIPMENT

2.6.1 Fans

2.6.1.1 Centrifugal Type Power Wall Ventilators

Fans shall be V-belt driven centrifugal type with backward inclined, non-overloading wheel. Motor housing shall be removable and weatherproof. Unit housing shall be designed for sealing to building surface and for discharge and condensate drippage away from building surface. Housing shall be constructed of heavy gauge aluminum. Unit shall be as scheduled with an airtight and liquid-tight metallic wall sleeve. Motor enclosure shall be dripproof type. Lubricated bearings shall be provided.

2.6.1.2 Centrifugal Type Power Roof Ventilators

Fans shall be spun aluminum V-belt driven with backward inclined, non-overloading wheel. Motor compartment housing shall be hinged or removable and weatherproof, constructed of heavy gauge aluminum. Fans shall be provided as scheduled. Motors enclosure shall be dripproof type. Lubricated bearings shall be provided.

2.6.2 Air Filters

2.6.2.1 Cartridge Type Filters

Filters shall be 2 inch (50mm) depth, sectional, replaceable dry media type of the size as required and shall have an average efficiency of 30 percent when tested according ASHRAE 52.1. Initial resistance shall not exceed .28 inches (7mm) at 500 FPM (2.54 /s) Filters shall be UL class 1. Media shall be pleated micro-glass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent air flow will have no effect on filter integrity of performance.

Filters shall be 12 inch (305 mm) depth, sectional, replaceable dry media type of the size indicated and shall have an average efficiency of 80 to 85 percent when tested according to ASHRAE 52.1. Initial resistance at 500 feet per minute (2.54 m/s) shall not exceed 0.56 inches (14 mm), water gauge. Filters shall be UL class 1. Media shall be pleated microglass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent airflow will have no effect on filter integrity or performance. Each filter shall be installed with an extended surface pleated media panel filter as a prefilter in a factory preassembled side access housing, or a factory-made sectional frame bank, as indicated.

2.6.2.2 Holding Frames

Frames shall be fabricated from not lighter than 16 gauge (1.6 mm) sheet steel with rust-inhibitor coating. Each holding frame shall be equipped with suitable filter holding devices. Holding frame seats shall be

gasketed. All joints shall be airtight. Frames to be constructed so air pressure assists in sealing filters to frames.

2.6.2.3 Filter Gauges

Filter gauges shall be dial type, diaphragm actuated draft and shall be provided for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches (98 mm) in diameter, shall have white dials with black figures, and shall be graduated in 0.01 inch (0.0025 kPa mm), and shall have a minimum range of 1 inch (0.25 kPa) beyond the specified final resistance for the filter bank on which each gauge is applied. Each gauge shall incorporate a screw operated zero adjustment and shall be furnished complete with two static pressure taps with integral compression fittings, two molded plastic vent valves, two 5 foot (1.5 m) minimum lengths of 1/4 inch (6.35 mm) diameter vinyl tubing, and all hardware and accessories for gauge mounting.

2.7 AIR HANDLING UNITS

2.7.1 Factory-Fabricated Air Handling Units

Units shall be variable air volume or constant volume as indicated in schedule, roof mounted, draw through, scheduled as indicated. Units shall include fans, coils, airtight insulated casing, prefilters, final filter sections, adjustable V-belt drives, mixing box vibration-isolators, and appurtenances required for specified operation. Vibration isolators shall be as indicated. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430. Unit shall come complete with all wiring suitable for single point electrical connection, including approved disconnects and breakers for ancillary loads.

2.7.1.1 Casings

Casing of each air handler shall have a complete stand alone welded steel tube frame with a welded steel channel base. Panels shall be 4-inch (100 mm) thick, insulated, double wall, steel panels, bolted and gasketed to the frame. Units shall be fabricated to allow removal of panels for access to internal parts and components, if necessary. Joints between sections shall be sealed air-tight, during assembly. Casing shall be rated for 8 inches (200 mm) water column differential pressure. Units shall be constructed with additional bracing and supports as required for the pressure rating, without sound or vibration problems. Casing sections shall be as indicated, galvanized steel, or 16 gauge (1.6 mm) steel outer casing protected with a factory baked enamel finish according to paragraph FACTORY PAINTING. Inner casing of double-wall units shall be minimum 18 gauge (1.0 mm) solid galvanized steel and perforated steel as scheduled. Casing shall be designed and constructed with an integral insulated structural steel frame such that exterior panels are non-load bearing. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 16 gauge (1.3 mm) outer and 18 gauge (1.0 mm) inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Access doors shall be minimum 24 inches (600 mm) wide and shall be the full height of the unit casing or a minimum of 6 foot (1800 mm),

whichever is less. A minimum 8 by 8 inches (200 by 200 mm) sealed glass. Access Sections shall be according to paragraph AIR HANDLING UNITS. Drain pan shall be double-wall insulated type constructed of 16 gauge (1.4 mm) stainless steel, double pitched to the drain connection. Drain pans shall be welded water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Drain pan shall be constructed so that the pan may be visually inspected easily including underneath the coil without removal of the coil and so that the pan may be physically cleaned completely and easily underneath the coil without removal of the coil. Casing insulation shall conform to NFPA 90A Single-wall casing sections handling conditioned air shall be insulated with not less than 1 inch (25 mm) thick, 1-1/2 pound density (24 kg per cubic meter) coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F (100 mm). Double-wall casing sections handling conditioned air shall be insulated with not less than 0.23 Btu/hr-sf-F (100 mm) of insulation. Foil-faced insulation shall not be an acceptable substitute for use with double wall casing. Double wall insulation must be completely sealed by inner and outer panels. Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Air handling unit casing insulation shall be uniform over the entire casing. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15080 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door, shall be provided in the fan and coil sections. Additional inspection doors, access doors and access sections shall be provided where indicated.

Floor shall be insulated double wall galvanized steel, sloped to drain. Provide 10 ga aluminum tread plate floor material with ample cross members (maximum 18-inch (457 mm) spacing) to support foot traffic. Floor to be welded water tight. Provide for four 3/4 inch (18 mm) anchor bolts for seismic anchoring. Locate one bolt in each corner of the air handler.

Provide two spare 1 inch (25 mm) conduit running the full length interior of each side of the Air Handling unit with a 4-inch by 4-inch (100 mm by 100 mm) junction box in each section suitable for control wiring. Conduit and junction boxes shall be located so as not to interfere with the normal function of the Air Handling unit including the removal of heating and cooling coils. Provide a junction box at one end at the exterior of the Air Handling Unit that will allow wiring to pass to the spare conduit on the interior of the Air Handling Unit.

Provide weather proof lights located in each section of the Air Handling Unit. Lights shall be completely wired to a single light switch located on the exterior of the Air Handling Unit and terminated in a junction box. Provide at least one 120v service receipt.

2.7.1.2 Cooling Coils

Coils shall be constructed of not less than 5/8 inch (16 mm) outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Coils shall be provided with not less than 5/8 inch (16 mm) outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Coils shall be tested hydrostatically at 300 psi (2000 kPa) or under water at 250 psi (1700 kPa) air pressure and suitable for 200 psi (1400 kPa) working pressure. Provisions shall be made for coil removal.

2.7.1.3 Air Filters

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.7.1.4 Fans

- a. Testing Requirements: The following factory tests are required:
 1. General: Sound power level ratings shall comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data" and shall be the result of tests made in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
 2. Unit's fans performance ratings for flow rate, pressure, power, air density, speed of rotation, and efficiency shall be factory tested and ratings established in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.
- b. Fan Section Construction: Fan section shall be equipped with a welded steel channel base for integral mounting of fan, motor, and casing panels. The fan scroll, wheel, shaft, bearings, and motor shall be mounted on a structural steel frame with frame mounted on base with vibration isolators. Vibration springs shall have 2-inch (12-mm) deflection and seismic restraints.
- c. Supply air fans shall be belt drive plenum fans with airfoil wheel. Drive shall be rated for 150 percent of scheduled motor horsepower or two full motor sizes whichever is greater. Centrifugal fans shall be supplied as shown in the plans and in the fan schedule. Fan shall be rigidly braced and reinforced with integral spring isolation on fan base to help prevent vibrations or pulsation. Wheel diameter and outlet areas shall be in accordance with the Airfoil standard sizes adopted by AMCA for non-overloading fans. Airfoil blades shall be continuously welded to both rim and backplate and shall be capable of Class III duty. The wheel inlet and fan inlet cone shall be fabricated of aluminum and carefully matched for optimal sound and air performance. Turned, ground and polished steel shafts shall be sized so the final critical speed is at least 25 percent over the maximum speed for each pressure class.
- d. Shaft Bearings: Grease-lubricated ball bearings selected for 200,000 hours average life, with grease fittings extended to an accessible location outside the fan section. Provide permanent drive shaft grounding to prevent electrical currents eroding the bearings and drive shaft of fans.

- e. Provide airflow traverse probes mounted in the fan inlets capable of continuously measuring the air handling capacity (air volume) of the fan. The fan inlet airflow traverse probes shall contain multiple total and static pressure sensors placed at concentric area centers along the exterior surface of the cylindrical probes and internally connected to their respective averaging manifolds. Sensors shall not protrude beyond the surface of the probe, nor be adversely affected by particle contamination normally present in building system airflows. The fan inlet airflow traverse probes shall be symmetrical averaging signal takeoffs, and shall be of aluminum construction with hard anodized finish with galvanized steel mounting hardware. The probes shall be capable of producing steady, non-pulsating signals of standard total and static pressure, without need for flow corrections or factors, with an accuracy of 3 percent of actual flow over a fan operating range of 6 to 1 capacity turndown. Provide a multi-line digital display transmitter suitable for use with the air flow monitoring system. Transmitter shall be capable of displaying the actual CFM, static and velocity pressure for the system. Transmitter shall be capable of providing a calibrated output signal of 0-10 VDC or 4-20maDC. Transmitter shall be factory mounted on the outside of the AHU. Coordinate the installation with the Owner.
- f. Fan Discharge Safety Enclosure: The safety enclosure to be expanded metal screen with a heavy steel frame which completely encloses the fan wheel. The top portion of the enclosure is removable to allow access to and removal of the wheel. Cataloged performance is based on fan without safety screen enclosure.

2.7.1.5 Access Sections and Filter/Mixing Boxes

Access sections shall be provided where indicated and shall be furnished with access doors as shown. Access sections and filter/mixing boxes shall be constructed in a manner identical to the remainder of the unit casing and shall be equipped with access doors.

2.7.1.6 Dampers

General: Leakage rate when tested in accordance with AMCA Standard 500 - Test Method for Louvers, Dampers and Shutters, shall not exceed 2 percent of air quantity calculated at 2,000 fpm face velocity through damper and 4 inches (100 mm) w.g. pressure differential.

- a. Damper operators shall be electrically operated.

2.7.1.7 Dampers

Dampers shall be as specified in paragraph CONTROLS.

2.7.1.8 Variable Frequency Drives

Variable frequency drives shall be as specified in Section 15910, DIRECT DIGITAL CONTROL SYSTEMS.

2.7.1.9 Extra Materials and Work

- a. Provide Two (2) complete spare sets of belts for each air handler in addition to the belts on furnished with each fan.

b. Provide Three (3) complete sets of filters for each air handler. Do not run the air handlers during the construction phase of the project without pre-filter and final filters in place. If the air handlers are operated during the construction phase of the project the contractor shall furnish the filters. The three (3) filters sets are intended to be used as follows:

1. During the final phase of construction for system check out and balancing and prior to occupancy.
2. The filters shall be changed prior to an owner directed two (2) week flush of the system immediately prior to occupancy. The contractor shall perform a flush of the building using 100% outside air for a period of not less than 14 days. During that time all of the VAV boxes shall be at a minimum of 50% open. This shall be coordinated with the owner to minimize energy usage during that time as well as avoid the possibility of freezing or overheating any systems that may be online in the building at that time.
3. The final set of filters shall be spares turned over to the owner at the beginning of occupancy.

2.8 TERMINAL UNITS

2.8.1 Variable Air Volume (VAV) and Dual Duct Terminal Units

2.8.1.1 Variable Volume, Single Duct

Variable volume, single duct, terminal units shall be provided with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Units shall control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge (200 to 1500 Pa). Internal resistance of units shall not exceed 0.4 inch water gauge (100 Pa) at maximum flow range. External differential pressure taps separate from the control pressure taps shall be provided for air flow measurement with a 0 to 1 inch water gauge (0 to 250 Pa) range. Unit volume controller shall be normally open upon loss of electrical power.

2.8.1.2 Variable Volume, Single Duct, Fan-Powered

Variable volume, single duct, fan-powered terminal units shall be provided with a calibrated air volume sensing device, air valve or damper, actuator, fan and motor, and accessory relays. Units shall control primary air volume to within plus or minus 5 percent of each air set point as determined by the thermostat with variations in inlet pressure from 3/4 to 6 inch water gauge (200 to 1500 Pa). Unit fan shall be centrifugal, direct-driven, double-inlet type with forward curved blades. Fan motor shall be either single speed with speed controller or three-speed, permanently lubricated, permanent split-capacitor type. Fan/motor assembly shall be isolated from the casing to minimize vibration transmission. Fan control shall be factory furnished and wired into the unit control system. A factory-mounted pressure switch shall be furnished to operate the unit fan whenever pressure exists at the unit primary air inlet or when the control system fan

operates. Fan wheels shall be furnished with an anti-rotation device to prevent backwards rotation of fan due to primary air flow.

2.8.1.3 Reheat Units

- a. Hot Water Coils: Hot-water coils shall be fin-and-tube type constructed of seamless copper tubes and copper or aluminum fins mechanically bonded or soldered to the tubes. Where required, coils shall be minimum of 2 rows. Headers shall be constructed of cast iron, welded steel or copper. Casing and tube support sheets shall be 16 gauge (1.6 mm), galvanized steel, formed to provide structural strength. Tubes shall be correctly circuited for proper water velocity without excessive pressure drop and they shall be drainable where required or indicated. At the factory, each coil shall be tested at not less than 250 psi (1700 kPa) air pressure and shall be suitable for 200 psi (1400 kPa) working pressure. Drainable coils shall be installed in the air handling units with a pitch of not less than 1/8 inch per foot (10 mm per m) of tube length toward the drain end. Coils shall conform to the provisions of ARI 410.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Equipment and Installation

Frames and supports shall be provided for pumps, air handling units, fans, coils, dampers, and other similar items requiring supports. Air handling units shall be floor mounted or ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 6 inch (150 mm) concrete pads or curbs doweled in place. Concrete foundations for circulating pumps shall be heavy enough to minimize the intensity of the vibrations transmitted to the piping and the surrounding structure, as recommended in writing by the pump manufacturer. In lieu of a concrete pad foundation, a concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. The concrete foundation or concrete pedestal block shall be of a mass not less than three times the weight of the components to be supported. Lines connected to the pump mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations.

3.1.2 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

3.1.1.3 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

3.1.1.4 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07840 FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07900 JOINT SEALING.

3.1.1.5 Metal Ductwork

Installation shall be according to SMACNA HVAC Duct Const Stds unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC Duct Const Stds, unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC Duct Const Stds shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.1.6 Exposed Ductwork

~~Exposed ductwork shall be fabricated from minimum 18 gauge (1.3 mm), Type 304L or 316L, stainless steel with continuously welded joints and seams. Ducts shall be pitched to drain at hoods and low points indicated. Surface finish shall match hoods. All exposed ductwork shall be galvanized steel except as noted on drawings pertaining to the soldering hood in room 116B. All exposed ductwork shall be sealed as specified and build in SMACNA standards similar to the unexposed ductwork unless noted otherwise within the drawing set.~~

3.1.1.7 Acoustical Duct Lining

Lining shall be applied in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C 916, Type I, NFPA 90A, UL 723, and ASTM E 84. Top and bottom pieces shall lap the side pieces and shall be secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA HVAC Duct Const Stds. Welded pins, cup-head pins, or adhered clips shall not distort the duct, burn through, nor mar the finish or the surface of the duct. Pins and washers shall be flush with the surfaces of the duct liner and all breaks and punctures of the duct liner coating shall be sealed with the nonflammable, fire resistant adhesive. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent

delamination of glass fibers. Duct liner may be applied to flat sheet metal prior to forming duct through the sheet metal brake. Lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA HVAC Duct Const Stds to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, will be acceptable.

3.1.1.8 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

3.1.1.9 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.1.10 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.1.1.11 Power Roof Ventilator Mounting

Foamed 1/2 inch (13 mm) thick, closed-cell, flexible elastomer insulation shall cover width of roof curb mounting flange. Where wood nailers are used, holes shall be pre-drilled for fasteners.

3.1.1.12 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.1.1.13 Smoke-Fire and Fire Damper Installation

- a. Install dampers at locations indicated on the Drawings and in accordance with manufacturer's UL approved installation instructions.
- b. Install dampers square and free from racking with blades running horizontally.
- c. Do not compress or stretch damper frame into duct or opening.
- d. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jackshaft.
- e. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.2 DUCTWORK LEAK TEST

Ductwork leak test shall be performed for the entire air distribution and exhaust system, including fans, coils. Test procedure, apparatus, and report shall conform to SMACNA Leakage Test Mnl. The maximum allowable leakage rate is 2 percent. Ductwork leak test shall be completed with satisfactory results prior to applying insulation to ductwork exterior.

3.3 DAMPER ACCEPTANCE TEST

All fire dampers and smoke dampers shall be operated under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Fire dampers equipped with fusible links shall be tested by having the fusible link cut in place. Dynamic fire dampers shall be tested with the air handling and distribution system running. All fire dampers shall be reset with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, the damper must be installed so it is square and free from racking.

3.4 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.5 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 3 days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.6 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Inside of air terminal units, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be

provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.7 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 24 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 16710

PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ANSI/TIA/EIA-568-B.1	Commercial Building Telecommunications Cabling Standard - General Requirements
ANSI/TIA/EIA-568-B.2	Commercial Building Telecommunications Cabling Standard - Balanced Twisted Pair Cabling Components
ANSI/TIA/EIA-568-B.3	Commercial Building Telecommunications Cabling Standard - Optical Fiber Cabling Components
ANSI/TIA/EIA-569-A	Commercial Building Standard for Telecommunications Pathways and Spaces
ANSI/TIA/EIA-569-A-1	Commercial Building Standard for Telecommunications Pathways and Spaces - Perimeter Pathways
ANSI/TIA/EIA-569-A-2	Commercial Building Standard for Telecommunications Pathways and Spaces - Furniture Pathways
ANSI/TIA/EIA-569-A-3	Commercial Building Standard for Telecommunications Pathways and Spaces - Access Floors
ANSI/TIA/EIA-569-A-4	Commercial Building Standard for Telecommunications Pathways and Spaces - Poke Thru Devices
ANSI/TIA/EIA-569-A-5	Commercial Building Standard for Telecommunications Pathways and Spaces - In Floor Systems
ANSI/TIA/EIA-569-A-6	Commercial Building Standard for Telecommunications Pathways and Spaces - Multi Tenant Pathways
ANSI/TIA/EIA-569-A-7	Commercial Building Standard for Telecommunications Pathways and Spaces - Cable Tray & Wireways

ANSI/TIA/EIA-598-A	Optical Fiber Cable Color Coding
ANSI/TIA/EIA-606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI/TIA/EIA-607	Commercial Building Grounding & Bonding Requirement for Telecommunications
ANSI/TIA/EIA-758	Customer Owned Outside Plant

INSTITUTE OF ELECTRONIC AND ELECTRICAL ENGINEERS

IEEE 802.XX SERIES

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-83-596	Fiber Optic Premises Distribution Cable
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment
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1.2 GENERAL

The work described in this section is specific to the telecommunications infrastructure requirements for the Fort Lewis Battle Simulation Center (FLBSC). This section should be read in conjunction with all other sections of the construction documents. All construction drawings provided are diagrammatic representations of the design intent. The contractor shall ensure the constructed communications cabling system conforms to all details as specified or recommended in the industry standards cited in this specification section, the construction drawings released and according to any specific Project Coordinator (defined in section 1.4.1), Owner Representative (DOIM) requirements identified and officially communicated in accordance with the contract.

1.3 THE WORK

The work described within includes all provisions, terminations, testing, and documentation necessary to provide a fully functional and standards compliant network cabling system.

The completed system will be comprised of various media types as defined in this section and the associated drawings and will be used to transport voice, data, and video signals internally to the facility as required by the Owner.

The horizontal cabling will consist of copper category 6 cabling and connectivity for voice and data work station connections, optical fiber (MM

& SM) outlets to miscellaneous locations, and miscellaneous RG-6 and RG-58 coaxial connections to wall and floor box outlets.

The backbone system (Intra-building) will consist of category 3 multi-pair copper cable and Single-mode and Multi-mode optical fiber cable within and between Commo Rooms and the Network Operation Center (NOC) spaces.

NOC spaces are all 120 series rooms to be used for the main distribution and interconnection points of the network cabling. Various spaces are controlled by DOIM and others are controlled by BSC. All work in these spaces shall be coordinated with the appropriate representative of that space. Direction taken, but not given, by the correct representative of that space is subject to re-work without incurred cost to the project. Identify the correct party for directing questions or concerns to avoid miscommunication.

Other work associated with this section includes all Commo Room build out responsibility and corridor, under floor, and overhead cable pathway coordination. Testing, labeling, documentation, and other standard installation practices shall also be included.

1.4 ADMINISTRATIVE REQUIREMENTS

1.4.1 Job Start Meeting

Before starting the work the Contractor shall attend a job start meeting at which his Project Foreman and Project Manager and any other of the parties as the Project Coordinator may designate shall be present (The Project Coordinator, as referred to in this specification section, shall be the contact designated for communications regarding the network infrastructure for the BSC. This person has yet to be identified to date, but will likely be a COE employee).

The communications contractors Certified Telecommunications Administrator (Must have 09 certification), as defined by the Washington State Department of Labor & Industries, shall also be present at this meeting. The contractor shall also employ an RCDD that can be requested as a technical resource if needed.

This meeting is intended to familiarize contractor personnel with the other parties that are involved with this project, to review all requests for facilities by the Contractor and subcontractors, to review the requirements and concerns, to permit the designers to review and interpret the project documents and for the Contractor to discuss the anticipated project schedule established in this Agreement.

1.4.2 Facility Review

Contractor shall conduct a walk through with the Project Coordinator of all work areas, describing specific work methods and proposed schedules, before commencing work, enabling the Project Coordinator to identify areas of concern, desired installation timetables and review important procedural and safety precautions.

1.4.3 Coordination with Owner

Advise Owner (DOIM) and Project Coordinator (COE) as early as possible of any product delays and minimum quantity requirements that may affect project timeline. Communication shall be done directly with the appointed Project Coordinator.

1.4.4 Contractor Foreman

The Contractor shall have a competent foreman, satisfactory to the Project Coordinator on site at all times during progress, with authority to act for him. All communications given to the superintendent by the Project Coordinator will be deemed to have been given to the Contractor. The Contractor without the approval of the Project Coordinator will not remove an approved Foreman from the site, unless that Foreman leaves the employment of the Contractor.

1.4.5 Access to Site

Contractor will be required to obtain permits for all vehicles accessing the Fort Lewis Post. Vehicles will require current insurance and registration information to be granted a Post permit. Employees working on the site will be required to show identification and receive clearances in accordance with Post policy. Further information regarding Post access for vehicles and personnel will be discussed at the job start meeting (1.4.1).

1.4.6 Personnel Identification

All contractor personnel shall be clearly identified by either uniform or company ID.

Contractor may also be issued and be required to wear an Owner provided Contractor ID's for required Card Access locations or Identification. All Owner/Military provided Contractor ID's must be returned at the end of Contract.

1.4.6 Work Restrictions

Hours of work are limited and will comply with those established by the General Contractor for construction.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for, or in conjunction with the Government. The following shall be submitted in accordance with standard SUBMITTAL PROCEDURES as described in the project manual:

Submittal List; G/COE (Corp of Engineers), DOIM

Within fifteen (15) days after date of execution of Contract Documents or issuance of Owner's letter of intent to execute the Contract or at the time of approval of the Physical Design documentation by the Project Coordinator, submit for review and acceptance a list of all materials, components, equipment, or system manufacturers whose products are proposed, as well as names of all sub-

tier Contractors this trade proposes to employ with qualifications of selection and specific functions they are to perform.

Any requests for substitutions of equipment or materials must be submitted and returned prior to submitting the Submittal List. Only specified or accepted manufacturers or suppliers shall appear on the Submittal List.

The complete Submittal List must be reviewed and accepted by the Project Coordinator prior to submittal of shop drawings and manufacturer's data. No shop drawings and manufacturer's data will be processed without an accepted Submittal List.

The Submittal List shall include all materials, equipment, and systems as identified to complete the Contractors work under this project.

Shop Drawings and Manufacturers Data; G, DOIM

The contractor is responsible for submittals as part of the quality assurance process to ensure that the proposed materials and resulting integration meets or exceeds the intention of the specifications. Where changes are recommended to improve the functionality, quality, and manageability of the overall project these are to be annotated and accompanied with an explanation.

All submittals shall be complete and contain all required and detailed information.

The Contractor shall make any corrections required by the Project Coordinator and shall resubmit the required number of corrected copies of the shop drawings or new samples of materials until approved. The Contractor shall direct specific attention in writing to any new revisions other than the corrections requested by the Project Coordinator on previous submissions.

No work requiring a shop drawings or sample submission shall be commenced until the submission has been approved by the Project Coordinator. All such work shall be in accordance with approved shop drawings and samples.

Submit manufacturer's data for all materials and equipment furnished as required in each of the individual specification sections.

Manufactures' product data shall consist of illustrations, standard schedules, performance charts, instructions, brochures, diagrams, cut sheets and other information furnished by the contractor to illustrate a material, product, component, equipment, or system for some portion of the work / project.

Samples as requested shall be physical examples that represent materials, equipment or workmanship and establish standards by which the work will be judged.

Samples, drawings, specifications, catalogs, etc., submitted to the Project Coordinator for review shall be properly labeled,

indicating specific service for which the material, product, component, equipment or system is to be used.

Catalogs, pamphlets, or other documents submitted to the Project Coordinator to describe items on which review is being requested shall be specific. The identification of items submitted in catalog, pamphlet, etc. shall be clearly made in ink (highlighter) or tag form. Data of a general nature will not be accepted.

Acceptance of any submitted data or shop drawings of material, product, component, equipment, system, devices, arrangement, and layout shall not relieve the Contractor from the responsibility of furnishing same of proper dimensions and weight, capacities, sizes, features, quantity, electrically and mechanically interchangeable, quality and installation details to perform efficiently the requirements and intent of the contract. Such acceptance shall not relieve Contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.

Shop drawings shall contain job titles and reference to the applicable drawing(s) and specification article or system. Where the Contractor is providing the physical design, the references are to be cross-indexed to his design and to the system. If there is a question as to the applicability, the Contractor is responsible for explaining to the Project Coordinator where the submittal fits into the project.

Individual shop drawings submittals that are not submitted in the manner described will be returned without review at the discretion of the Project Coordinator.

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided do conform to such requirements shall be provided. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Manual and Technical Documents; G, DOIM

The Contractor will be required to provide four (4) copies of the manufacturers' installation, operations, and maintenance manuals and technical documents for each device type.

Statement of Warranty/Qualifications; G, DOIM

The Contractor will provide a statement of warranty based on the Vendors' / Manufacturers' and the Contractor's warranties. The warranties are to take into consideration the methods in which the Owner will be operating the complex and the training and certifications provided by the Contractor / Vendor.

Written manufacturer warranty/certification documentation that the telecommunications distribution system complies with all applicable

industry standards listed in part 1.1 - References. This documentation shall be issued directly by the manufacturer providing the warranty and assumes the issuing manufacturer has reviewed and approved all test results submitted by the contractor for each cable/strand/conductor installed on the project.

The Contractor shall submit proof of certification that all the installers are factory certified to install and test the provided products.

The Contractor shall submit certification that all the Company is factory certified to install and test the provided products.

Record Drawings; G, DOIM

During the installation, the Contractor shall maintain a record copy of the system design, specifications, and a complete set of the implementation drawings on the job site and make such notations and updates thereon as required to constitute an accurate record of all installations pursuant to the issue of As-Built drawings. These will be used by the Quality Assurance team to monitor the project progress and annotate discrepancies.

The Contractor shall maintain timely and accurate records of all device locations. Major deviations in work as actually installed from work indicated in the drawings and specifications must be carefully documented. This record-keeping must be kept current and shall be recorded on the Contract documents as appropriate.

Contractor shall produce a legible copy of the record drawings through out the project when requested by the Project Coordinator.

As between the Contractor and Owner, the Specifications and the accompanying Drawings are the property of Owner and shall be returned to Owner at the completion of the Contract and before the Work will be accepted.

As-Built Drawings; G, DOIM

During the work's progress, the Contractor shall record all changes and deviations on a set of Contract documents. The Contractor shall review in advance with Project Coordinator the desired depth of detail that shall be necessary for Final Approved As- Built drawings. The minimum requirement will be a clean and final set of the record copy drawings.

Submit record drawings (As-Builts) for the installed wiring system infrastructure per ANSI/TIA/EIA-606. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings as well as on an attached Excel spreadsheet. Spreadsheet shall be broke down by Commo Room and the cables served by the given room.

Upon completion of work, but before final approval, the Contractor shall submit a hard copy upon which the installed work was based with all the changes.

The Contractor shall annotate three (3) sets of system drawings to show the as-built conditions and provide them to the Contracting Officer for delivery of one (1) copy to the Director of Public Works, one (1) copy for the Battle Simulation Center, and one (1) copy to the DOIM. This shall include, but not be limited to, all cable types, sizes, counts, measured distances to all splices and terminals, terminal numbers and any other details and sketches necessary for preparation of accurate plant-in-place type record drawings. As-built drawings shall be submitted in electronic (AutoCad - CD-ROM) and hard copy form within 6 weeks following project acceptance.

Test Plan/Reports/Results and Configuration Information; G, DOIM

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Upon completion of work, but before final approval, the Contractor shall submit test results and configuration information as required by each of the individual specification sections.

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on 89 mm (3-1/2 inch) diskettes and CD-ROM in ASCII& Excel format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within [14] days after completion of testing.

1.6 QUALIFICATIONS

1.6.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a Certified Telecommunications Contractor, hereafter referred to as the Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation to be considered certified:

- a. Contractor shall have a minimum of (5) years experience in the application, installation and testing of the specified systems and equipment.
- b. Contractor shall be in good standing with the manufacturer providing the products and system warranty documentation, have been in the manufacturers warranty program for at least (1) full year, and provide proof of company certification from the manufacturer(s).

- c. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
- d. All installers assigned to the installation of this system or any of its components shall have a minimum of (3) years experience in the installation of the copper and fiber optic cabling and components.
- e. Contractor shall be capable of providing a designated, on-site, non-working Project Manager/Superintendent with Registered Communications Distribution Designer (RCDD) certification from BICSI to oversee the project installation and to facilitate all Owner correspondence throughout the course of the project with the FLBSC Project Coordinator.
- f. Contractor must provide certification for each technician responsible for the final testing of the installed cabling system. This includes proof that the successful testing of category 6 cabling systems has been accomplished and that the technician(s) are also accomplished in the testing of MM & SM optical fiber cabling. Submit information on the testers to be used.
- g. Contractor must be licensed, bonded, and insured in the State of Washington.
- h. Telecommunications Administrator, normally employed by the contractor, with a Washington State Electrical administrator 09 certificate must be on site at all times while communications related work is being conducted.

1.6.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of (5) years experience in producing the types of systems and equipment specified.

1.7 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants. It is the responsibility of the selected contractor to provide appropriate storage. Coordinate any storage plans or needs with appointed Owner Representative.

1.8 FIELD ORDERS, CHANGE ORDERS AND CHANGE ORDER REQUESTS

The following provides a detailed process to follow if a change to the scope or to the Contract is required:

A Field Order (FO) will be issued by the Project Coordinator to the contractor. The Field Order will describe the required change.

If change does not impact the price or affect the completion date of the project the contractor shall accept the Field Order and complete the work as requested. If the field order will affect the price or time of completion

the contractor must submit a Change Order Request, indicating with supporting documentation the reason a change order is required and if any, the price adjustment associated with the change. The contractor shall not complete the work until written approval is received by the contractor from the Project Coordinator in the form of a signed Change Order that has been processed through the appropriate channels.

If the Project Coordinator accepts the Change Order Request, the Project Coordinator will then issue a Change Order authorizing the change in price or time.

A written Change Order must be signed by both the Project Coordinator and an authorized Owner Representative prior to the contractor proceeding with the implementation of the investigated changes.

This Change order must also comply with the official processes described in the contract documentation from the Architect.

1.9 PROJECT CONDITIONS

To ensure a constructible communications cabling system, the contractor shall examine all drawings and specifications to familiarize themselves with the type of construction materials to be used, and the nature and extent of work provided in other sections of the construction documents. Any clarifications needed shall be requested to the General Contractor (through the appropriate channels) no later than ten (10) working days before bid opening; upon contract award, contractor shall assume full responsibility for any cost incurred due to changes as required to complete the work as defined in this section if questions were not asked by the indicated time.

Verify dimensions, correct location of hardware, and layouts with Project Coordinator before proceeding with the installation of any hardware, cabling, and/or connections. Due to the complex nature of this communications installation it is advised that any uncertainty as to the correctness of a task to be performed by the contractor be verified with the appropriate FLBSC or FLBSC designated representative prior to performing that task. Contractor will be liable for the correction of any improperly performed task that could have been clarified prior to proceeding.

1.10 MANUFACTURERS

The cabling system specified in this document is based on a Panduit connectivity and support solution. Unless explicitly noted within this section, this shall include all patch panels, termination frames, termination blocks, connectors, wire management, faceplates, and all other associated components that are produced by that manufacturer. Each component installed shall be the newest model and have the highest performance within the product category as advertised by the respective manufacturer within thirty (30) days of the time of installation.

Panduit has been used as the baseline solution for this project due to some unique product offerings that will best serve the clients needs and space requirements. Other manufacturers may also provide similar products and features and may be used in place of the Panduit parts so long as the component requirements and overall system objectives are explicitly met as they would be by using a complete Panduit solution.

To maintain a competitive bidding situation it is advised for contractors to bid the project using ONLY Panduit part numbers as provided and any other products required to complete the project. Upon award and providing the proper submittals the contractor may at that time be granted permission to substitute the specified parts with those approved alternates. Any dollars to be saved per any approved substitution will be documented and deducted from the contract price.

The cable portion of the project is open to all manufacturers provided that a 20+ year warranty can be provided in conjunction with the selected connectivity manufacturer. Appropriate documentation supporting the cable/connectivity partnership must be provided to the Project Coordinator prior to installation of the system as well as upon project final testing and acceptance.

1.11 PERMITS, LICENSES, INSPECTIONS AND FEES

Contractor shall be responsible for obtaining any cost associated with required permits, licenses, inspections or fees.

1.12 PROJECT PHOTOGRAPHS

Photographs shall be taken:

Prior to concealment of any interior or exterior conduit pathways to be encased in concrete prior to concrete pour. Exterior conduits shall be photographed again prior to backfill. Photos must be taken at such locations that the entire length of the pathway is captured in the photograph.

Prior to concealment of any other cables that will become inaccessible after concealment, such as all direct buried cables shall also be photographed.

Of all interior manhole wall elevations that are intended for classified cabling as to document the pathway as complete and secure for that particular use.

Of the entire manhole after all cables are placed and racked as complete.

Of any other installation situation as required by the Project Coordinator.

1.13 PERIODIC FIELD OBSERVATION REPORTS

The Project Coordinator will conduct site visits as required to monitor the progress and quality of the workmanship and the work environment as well as the surrounding facility. Any item found by the Project Coordinator to be deficient will be documented in a periodic Field Observation Report. The contractor shall take appropriate actions to immediately rectify any items deemed unacceptable by the Project Coordinator. The contractor shall not wait for a hard copy of the periodic Field Observation Report if the action required to rectify the situation is obvious and clear.

1.14 INSPECTIONS AND TESTS

Except as otherwise provided in this Contract, inspection and tests of material and workmanship required by this Contract shall be made at reasonable times and at the site of the Work, unless the Project Coordinator determines that such inspection or test of material which is to be

incorporated in the Work shall be made at the place of production, manufacture, or shipment of such material. To the extent specified by the Project Coordinator at the time of determining to make off-site inspection or test, such inspection or test shall not relieve the Contractor of responsibility for damage to or loss of the material prior to acceptance, nor in any way affect the continuing rights of the Owner after acceptance of the completed Work.

The Contractor shall, without charge, replace any material or correct any workmanship found by the Owners Representative not to conform to the Contract requirements, unless in the public interest the Owners Representative consents to accept such material or workmanship with an appropriate adjustment in Contract Price. The Contractor shall promptly segregate and remove rejected material from the premises. The Contractor will be charged with the additional cost of any test or inspection of the replaced material or corrected workmanship.

If the Contractor does not promptly replace rejected material or correct rejected workmanship, the Owner:

- 1) May, by contract or otherwise, replace such material or correct such workmanship and charge the cost thereof to the Contractor, or
- 2) May terminate the Contractor's right to proceed in accordance with the General Conditions.

The Contractor shall furnish promptly, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspection and test as may be required by the Project Coordinator. All inspection and test by the owner shall be performed in such manner as not unnecessarily to delay the work. Special, full-size, and performance tests shall be performed as described in this Contract. The Contractor shall be charged with any additional cost of inspection when material and workmanship are not ready at the time specified by the Contractor for its inspection.

Should it be considered necessary or advisable by the Owner at any time before acceptance of the entire Work to make an examination of work already completed, by removing or tearing out same, the Contractor shall, on request, promptly furnish all necessary facilities, labor, and material. If such work shall have been covered without the approval of the Project Coordinator, or if such work is found to be defective or non-conforming in any material respect due to the fault of the contractor or his subcontractors, he shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, an equitable adjustment shall be made in the Contract Price to compensate the Contractor.

1.15 CLEANUP

The Contractor shall keep the site and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract before leaving for the day. The Project Coordinator has the right to call the Contractor back to perform the cleanup. If the Contractor fails to perform the cleanup another contractor will be engaged at the Contractors expense to perform the cleanup. Any fees resulting from the cleanup of Contractors work area will be withheld from the final settlement.

Upon completion of the Work and before acceptance and final payment will be made, the Contractor shall clean and remove from the site, all surplus and discarded materials, temporary structures and debris of every kind. He shall leave the site in a neat and orderly condition at least equal to that which originally existed. Surplus and waste materials removed from the site shall be disposed of in accordance with applicable laws and regulations.

It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the premises. After all tests are made and installations completed satisfactorily:

- 1) Thoroughly clean entire installation, both exposed surfaces and interiors.
- 2) Remove all debris caused by work.
- 3) Remove tools, surplus, materials, when work is finally accepted.

1.16 PROJECT CLOSEOUT

A portion of the Contract amount will be retained until the Owner determines by inspection that all provisions of the project documents have been fulfilled and certifies that all other provisions of the Agreement have been fulfilled.

Prior to release of this retainage, the Contractor shall have provided all required documentation, performed all required tests and have completed the work to the satisfaction of the Project Coordinator. In addition, any certifications required by local or governmental authorities having jurisdiction that should have been transferred to the Owner shall be received.

1.17 ACCEPTANCE

After the successful installation inspections and functional testing by the Project Coordinator and Contractor, the Project Coordinator will determine if there are any open issues or discrepancies and notify the Contractor. Upon completion or determined failure, the Project Coordinator will issue written notification to the Contractor as to the status of the installation acceptance.

1.18 QUALITY ASSURANCE

The Project Coordinator will perform inspections in evaluation and functional testing of the subsystems as completed and the total systems. The Contractor will be responsible for assisting with these functionality and performance tests. The Demonstration setup will be the benchmark for comparison of the results. Failure of the subsystems and/or systems to perform as specified will be considered as a failure to perform under the Terms and Conditions.

The Contractor shall lead in an overall Quality Assurance Program.

All materials used shall bear the Underwriters' Laboratory, Inc. label, provided a standard has been established for the materials in question.

All products, components, devices, equipment, and materials shall be new and unused, clean, free of defects, and free of damage and corrosion.

Manufacturers of equipment shall be firms regularly and currently engaged in the production of equipment and accessories provided.

Apply and install materials, equipment, and specialties in accordance with manufacturers written instructions. Conflicts between the manufacturer's instructions and the contract documents shall be referred to in writing to the Project Coordinator for resolution.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment to be used on this project shall be selected from the specified products in this document. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 INTRA-BUILDING/INTER-BUILDING COPPER & OPTICAL FIBER BACKBONE CABLES

Defined in this section are the products and cables required to provide copper and fiber interconnectivity between all of the Commo Rooms and NOC Rooms within the facility and the required products to connect the facility to the main Post (DOIM) backbone/Bldg. 2003.

2.2.1 Backbone Cable (Copper) (Voice) - Intra-building

Copper backbone cable required within the FLBSC shall meet the requirements of ANSI/TIA/EIA-568-B for Category 3 100-ohm unshielded twisted pair cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid annealed bare, un-tinned copper, 24 AWG (0.5mm). Riser/backbone cable will be required for this projects Intra-building backbone. Tie cables between the various NOC spaces and routed in overhead tray may be CMR rated multi-pair cable. All copper backbone cables feeding from the NOC spaces to other facility Commo Rooms (via under slab conduits) will not require the use of PE-89 or other jell-filled cable per DOIM. Hence, standard CMR rated cable is acceptable. Confirm this with DOIM representative prior to installation.

a. Specified Manufacturer

General/Essex/Belden/Mohawk or Equal (CMR)

2.2.2 Backbone Cable (Optical Fiber) (MM) (Data) - Intra-building

Optical fiber backbone cable required within the FLBSC shall meet the requirements of ANSI/TIA/EIA-568-B for 50 um multi-mode optical fiber cables. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated for indoor/outdoor use and comply with NFPA 70. Strand counts vary and are indicated on construction

drawings. Availability of 2 - 144 strands shall be available. MM fiber shall be capable of supporting 10 Gig Ethernet @ distance of at least 85 meters at the 850 nm window.

- a. Specified Manufacturer
Berk-Tek Adventum (GigaLite) or Equal

2.2.3 Backbone Cable (Optical Fiber) (SM) (Data) - Intra-building

Optical fiber backbone cable required within the FLBSC shall meet the requirements of ANSI/TIA/EIA-568-B for single-mode optical fiber cables. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated for indoor/outdoor use and comply with NFPA 70. Strand counts vary and are indicated on construction drawings.

- a. Specified Manufacturer
Berk-Tek Adventum or Equal

2.2.4 Backbone Cable (Copper) (Voice) - Inter-building - OSP

OSP copper cable and connection gear to/from BSC will be included in the Outside Plant specifications. Section 16711 will be released as an addendum and cover all OSP related work and terminations.

2.2.5 Backbone Cable (Optical Fiber) (SM) (Data) - Inter-building - OSP

OSP fiber optic cable and connection gear to/from the BSC will be included in the Outside Plant specifications. Section 16711 will be released as an addendum and cover all OSP related work and terminations.

2.2.6 Horizontal Cable (Copper) (Voice/Data) - Intra-building

Horizontal cable shall exceed the requirements of ANSI/TIA/EIA-568-B for Category 6 cable. Cable shall be label-verified and must provide conductor pair separation by utilizing a + or x type center separator or individual conductor pair pathways integrated into the cable sheath design. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMR per NFPA 70.

- a. Specified Manufacturer
Mohawk/CDT AdvanceNet
Berk-Tek LanMark 1000
Belden MediaTwist or Equal

2.2.7 Horizontal Cable (Copper - Coaxial) (Data/Video) - Intra-building

Horizontal coaxial cable shall meet or exceed the requirements of ANSI/TIA/EIA-568-B for 75 Ohm (RG-6) coaxial cable. Cable shall be label-verified and have a quad shield. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMR per NFPA 70. Cable shall be tested to have a frequency range of at least 2.2 GHz.

- a. Specified Manufacturer
Commscope 5740R or Equal

2.2.8 Horizontal Cable (Copper - Coaxial) (Voice/Data) - Intra-building

Horizontal coaxial cable shall meet or exceed the requirements of ANSI/TIA/EIA-568-B for 50 Ohm (RG-58) coaxial cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMR per NFPA 70.

- a. Specified Manufacturer
Commscope 3130 or Equal

2.2.9 Horizontal Cable (Optical Fiber) (MM) (Data) - Intra-building

(4) strand horizontal optical fiber cable shall meet the requirements of ANSI/TIA/EIA-568-B for 50 um multi-mode optical fiber cables. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMR per NFPA 70.

- a. Specified Manufacturer
Berk-Tek Premise Distribution (GigaLite) or Equal

2.2.10 Horizontal Cable (Optical Fiber) (SM) (Data) - Intra-building

(4)strand optical fiber cable shall meet the requirements of ANSI/TIA/EIA-568-B for single-mode optical fiber cables. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMR per NFPA 70.

- a. Specified Manufacturer
Berk-Tek Premise Distribution (GigaLite) or Equal

2.3 WORKSTATION HARDWARE - 4 PORT SCENARIOS (WALL/OVERHEAD TRAY/WAP'S)

Hardware shall be in accordance with ANSI/TIA/EIA-568-B. The single gang faceplate solution described below is required for the all 4 port wall outlets, and all wireless access point ceiling locations.

2.3.1 Telecommunications Outlet Faceplates - Single-gang

Outlet faceplates shall be single-gang plates capable of housing up to 6 individual jack modules. Faceplates shall provide integrated label windows to allow for protected outlet labeling. The faceplate solution shall require 1/3 sized modular inserts to house the jacks within the plate, providing flexibility for future additions and front loading capabilities.

- a. Specified Manufacturer
Panduit or Equal
Part# CBE** (Executive single gang FP frame)

2.3.2 Telecommunications Outlet Faceplate Modules - 1/3 size modules

To populate the faceplates described above (3) - 1/3 size modules will be required for each faceplate. This solution will allow for the Owner to be able to add 2 more jacks in the future if required to each faceplate.

Installation will require (2) modules that accept jacks and (1) module that is a 1/3 size blank.

a. Specified Manufacturer

Panduit or Equal

Part# CHF2M**-X (1/3 size insert for jacks - flat)

Panduit or Equal

Part# CHB2M**-X (1/3 size blank insert)

2.3.3 Telecommunications Outlet Jacks - 4 jack wall outlets, and 4 jack WAP outlets, overhead PP

Most of the cables terminated in the above faceplates will terminate with category 6 jacks. Jacks shall meet or exceed the category 6 performance standards defined in EIA/TIA-568-B and be warrantable with the chosen cable manufacturer.

Also required will be the use of 6-pin, RJ-14 jacks for the termination of any voice designated cable terminations at the work area (see drawings and legend). Jacks must come in various colors as required and be accepted by the specified faceplate and or patch panels per drawings.

Cable tray mounted patch panels with wire managers mounted to support brackets will be required throughout the facility. See drawings for detail and location.

a. Specified Manufacturer

Panduit or Equal

Part# CJ688T3** (Category 6 jack)

Part# CJ66xx (RJ-14's)

Part # CPP48WBL (for tray mounted PP)

Part # NCMH2 (for hanging PP)

Part# OR-60400235 (Hanging PP bracket)

2.4 WALL/FLOOR MOUNTED CRUZ BOXES

Throughout the facility there will be "Cruz Boxes" located on the walls and in the floor. A Cruz box comes in two variations the Standard Cruz box (designated on the prints and the legend as a square with a C in it) and a Hybrid Cruz box (designated as a square with a C in it and a raised H above that). The materials requirements for the Cruz boxes (both versions) will be the same for both the wall and floor applications (Inserts only - faceplate bezel to be from Spider Manufacturing and provided by the electrical contractor. Communications contractor will be responsible for providing faceplates, modules, cable, terminations, labeling, and testing. All Cruz box locations, Wall and Floor, will consist of (8) single-gang faceplate openings (2 - 4 gang openings).

2.4.1 Standard Wall/Floor mounted Cruz boxes - Faceplates and Inserts

Provide the required faceplates and inserts to fully populate the wall/floor mounted Cruz boxes (symbol = a square w/C) as shown on sheet T701 Detail # 1 & 3. In this Standard Cruz box scenario the top (4) single-gang openings will be fully populated and the left single-gang opening on the lower row will also be populated though not completely. The remaining (3) single-gang openings will be blanked off using the same style faceplate and required number of blank inserts to maintain a uniform look throughout the project.

a. Specified Manufacturer

Spider Manufacturing
Part# PA308 (Panduit Mini-Com adapter plate)

~~Spider Manufacturing
Part# OR-322 (Ortronics Mini-Com adapter plate for
MSE/FM connections) - May not be required if
Panduit can produce the required binding post
insert by the time of installation.~~

Panduit
Part # CMBP*** (Mini-Com binding post module for
MSE/FM - connections)

Panduit
Part # CHF2M**-X (1/3 size insert for jacks - flat)
Panduit
Part # CHB2M**-X (1/3 size blank insert)
Panduit
Part # CMB**-X (1-port blank insert)

2.4.2 Hybrid Wall mounted Cruz boxes - Faceplates and Inserts

Provide the required faceplates and inserts to fully populate the wall/floor mounted Hybrid Cruz boxes (symbol = a square w/C and a raised H) as shown on sheet T701 Detail # 2 & #4. In this Hybrid Cruz box scenario the top (4) single-gang openings will be fully populated and all of the lower gangs will have some variation of jacks in them as well. Various blanks will be required to maintain uniformity. All unpopulated ports must be blanked accordingly.

a. Specified Manufacturer

Spider Manufacturing
Part# PA308 (Panduit Mini-Com adapter plate)

~~Spider Manufacturing
Part# OR-322 (Ortronics Mini-Com adapter plate for
MSE/FM connections) - May not be required if
Panduit can produce the required binding post
insert by the time of installation.~~

Panduit
Part # CMBP*** (Mini-Com binding post module for
MSE/FM - connections)

Panduit
Part # CHF2M**-X (1/3 size insert for jacks - flat)
Panduit
Part # CHB2M**-X (1/3 size blank insert)
Panduit
Part # CMB**-X (1-port blank insert)

2.4.3 Connector requirements for Standard Cruz boxes

Provide the required connector modules to terminate all cables in the Standard Cruz box as specified. See Detail # 1 & 3 on Sheet T701. Faceplate

#1 requires (6) binding post connectors, FP #2 requires (6) binding post connectors, FP #3 requires (6) binding post connectors, FP #4 requires (6) category 6 RJ-45 connectors, FP #5 requires (3) category 6 RJ-45 connectors and (2) RJ-14's and FP#6, 7, & 8 require blanks (3) faceplates and (9) 1/3 size blanks.

a. Specified Manufacturer

Spider Manufacturing

Part# PA308 (Panduit Mini-Com adapter plate)

~~Spider Manufacturing~~

~~Part# OR322 (Adapter plate to accept binding posts)~~

~~Ortronics~~

~~Part # OR-63700044-xx (Binding post assembly)~~

~~Part number may change to one provided by Panduit by installation time. Confirm with Engineer/Local Panduit representative prior to installation.~~

Panduit

Part # CMBP*** (Mini-Com binding post module for MSE/FM - connections)

Panduit

Part # CJ688T3** (Category 6 jack)

Panduit

Part # CJ66xx (RJ14 jack)

* All jack inserts shall be color coded per Project Coordinator/ Facility requirements. Coordinated various color requirements prior to ordering and installing.

2.4.4 Connector requirements for Hybrid Cruz boxes

Provide the required connector modules to terminate all cables in the Hybrid Cruz box as specified. See Detail # 2 on Sheet T701. Faceplate #1 requires (6) binding post connectors and module inserts, FP #2 requires (6) binding post connectors and module inserts, FP #3 requires (6) binding post connectors and module inserts, FP #4 requires (2) "F" type coaxial connectors (RG-6), (1) 1/3 size blank insert (middle), and (2) BNC type coaxial connectors (RG-58), FP #5 requires (6) category 6 RJ-45 connectors, FP #6 requires (3) category 6 RJ-45 connectors, and (2) RJ-14's, FP #7 requires (4) ST adapter modules (and the MM connectors to terminate the strands behind the adapter), and (1) 1/3 size blank (middle), and FP#8 requires (4) ST adapter modules (and the SM connectors to terminate the strands behind the adapter), and (1) 1/3 size blank (middle).

a. Specified Manufacturer

Spider Manufacturing

Part# PA308 (Panduit Mini-Com adapter plate)

~~Spider Manufacturing~~

~~Part# OR322 (Adapter plate to accept binding posts)~~

~~Ortronics~~

~~Part # OR-63700044-xx (Binding post assembly)~~

~~Part number may change to one provided by Panduit by installation time. Confirm with Engineer/Local Panduit representative prior to installation.~~

Panduit
Part # CMBP*** (Mini-Com binding post module for
MSE/FM - connections)

Panduit		
Part #	CMFBA**	("F" connector module)
Panduit		
Part #	CMBA**	(50 Ohm "BNC" connector module)
Panduit		
Part #	CJ688T3**	(Category 6 RJ-45 jack)
Panduit		
Part #	CJ66**	(RJ-14 jack)
Panduit		
Part #	CMST	(ST Adapter Module - for MM & SM)
Panduit		
Part #	FSTMBL	(50 um MM ST fiber connectors)
Panduit		
Part #	FSTSBU	(SM ST fiber connectors)

* All jack inserts shall be color coded per Project Coordinator / Facility requirements. Coordinate various color requirements prior to ordering and installing.

2.5 ALL PROJECT REQUIRED PATCH CORDS (WORK AREA)

Include the below listed patch cord quantity pricing in your project total.

Include Copper, Optical fiber (MM & SM), Coaxial, and Cross-connection wire necessary to connect/interconnect every (100%) port present in ALL Commo Rooms and NOC Rooms.

Include Copper, Optical fiber (MM & SM), and Coaxial patch cords necessary to connect every (100%) port present in the Administrative work areas.

Include Copper, Optical fiber (MM & SM) and Coaxial patch cords necessary to connect/interconnect (100%) of the ports present in the simulation spaces and other offices, conference rooms, and support spaces throughout the facility.

Also provide separate per piece pricing for each of the below listed Part #'s with bid documents. Owner may elect to purchase or require more patch cords than what is listed.

a. Specified Manufacturer

Panduit Or Equal	
Part#	UTPCTGX** (X' Cat 6 cord, Work Area, Color TBD)
Panduit	
Part #	UTPCTGX** (X' Cat 6 cord, Closet, Color TBD)
Panduit	
Part #	F5D2-2M** (X' 50 um MM ST-ST fiber jumper, WA)
Panduit	
Part #	F5D2-2M** (X' 50 um MM ST-ST fiber jumper, TR)
Panduit	
Part #	F9D2-2M** (X' SM ST-ST fiber jumper, Work Area)
Panduit	

Part #	F9D2-2M**	(X' SM ST-ST fiber jumper, Closet)
Manufacturer	XXX	
Part#	TBD	(75 Ohm coaxial patch)
Manufacturer	TBD	
Part#	TBD	(50 Ohm coaxial patch)
Manufacturer	TBD	
Part#	TBD	(Cross-connect wire)

2.6 NETWORK OPERATIONS CENTER (NOC) AREA ROOM BUILD OUT

The rooms considered to be in the NOC area are as follows; (120 A-F) DOIM/DSN/NIPRNET/Commo Room, LH Reach, Sim/Stim, C2Wan, MSE/FM, and SIPRNET. Each room may have varied requirements from the other. Some requirements pertain to all rooms in the NOC area and will be expressed as "All NOC area rooms require." Room specific requirements will be broken out by room name.

2.6.1 Telephone Backboard

All NOC area rooms require 4' X 8' X 3/4" plywood backboard to be provided on all walls. Plywood shall be painted with (2) coats of fire retardant paint (gray or white) and provided by the Communications contractor.

2.6.2 Overhead Cable Tray

All NOC area rooms require the installation of overhead cable tray as show on prints. Include all supports, connections, waterfalls/drop-outs, wall-sleeves (coordinate with Electrical Contractor to confirm responsible party), transitions, tooling, rack clamps, and grounding necessary to provide a complete routing system. Cable tray shall be center hung, seismically braced to local code, connected using splice washer system, and provided by the Communications contractor. Tray must be installed using recommended manufacturer methods and tooling. Tray shall be Black in color.

a. Specified Manufacturer

Flextray/GS Metals or Equal	
Part#	FT4x24x10BLE (24" ladder/telecom tray)
Part#	FT4x12x10BLE (12" ladder/telecom tray)
Flextray/GS Metals or Equal	
Part#	Include All required miscellaneous pieces to complete the system.

2.6.3 19" Telecom/Equipment Rack

All NOC area rooms other than DOIM and MSE/FM require the installation of standard 19" equipment racks as shown on prints. IDF area within the DOIM space also requires 19" racks (See prints). Racks shall be black in color. Install all racks as shown on prints even if not currently being occupied by terminations or equipment. Racks shall be mounted to the floor for base support and attach to the overhead cable tray system.

All Telecommunication/Equipment racks identified in section 16710 and 16711 shall be seismically braced per governing code and approved by a structural engineer.

a. Specified Manufacturer

Panduit or Equal	
Part#	CMR19X84 (Standard Equipment Rack)

2.6.4 Vertical Cable Management - 19" racks

All installed 19" racks will be equipped with 8" vertical wire managers as detailed on drawings. (1) 8" vertical wire manager shall be installed on the end of each rack row with (1) 8" vertical wire manager installed between every two racks. Reference individual Commo/NOC room details (T500's). Vertical wire managers will have integral bend radius control supports to manage the transition from patch panel to vertical manager without the need for horizontal cable management, wire manager finger spacing shall align with rack spaces, shall have built in cable management spools, and dual hinged, metal, full length doors front and rear. Wire managers shall be one piece units.

a. Specified Manufacturer

Panduit or Equal	
Part#	NCMV8 (8" vertical wire manager)

2.6.5 Termination Frames - DOIM & MSE/FM

All termination requirements related to outside plant work will be released as an addendum. At a minimum anticipate the use of Newton Telco Frames, Marconi wall mounted building entrance protection blocks, Marconi rack mounted R399's with 100' tip cables, and necessary fuses.

2.6.6 19" Rack mount LIU (Fiber Optics)/Connectors/Adapter Plates

As indicated on prints many of the 19" equipment racks will house optical fiber terminations. Enclosures required to house those terminations shall be either a 3 RU 54/108 strand capable enclosures or 72/144 strand capable enclosures as indicated on drawings. This is the termination requirements for all intra-building horizontal and optical fiber cable terminations.

a. Specified Manufacturer

Panduit or Equal	
Part#	FRME3 (3 RU optical fiber enclosure)
Part#	FRME4 (4 RU optical fiber enclosure)
Part#	FAP6WST (6 pack pre-loaded ST adapter)
Part#	FSTMBL (MM ST connector - Black)
Part#	FSTMRD (MM ST connector - Red)
Part#	FSTSBU (SM ST connector)

2.7 COMMO ROOM BUILD OUT

Each Commo Room in the facility will require build out. Racks (19"), wire management, backboards, and cable tray are the same as listed above for the NOC Spaces. These Commo rooms will require the addition of patch panels, connectors, fiber optic terminations and panels, wall mounted gear, etc. Some of these products will also be required as specified in the NOC Rooms.

2.7.1 Patch Panels

The patch panels to be used on this project shall be "V" shaped and not require the use of horizontal cable management. Patch panels shall be modular, accepting individual multi-media modules, occupy 2 rack units of

space, and allow for the color coding of modules. Panels must be capable of supporting 48 connections per panel.

- a. Specified Manufacturer
Panduit or Equal
Part# CPPLA72WBL (Flying V, 3-2 RU, 72 port PP)

* Coordinate insert colors prior to purchase and installation

2.7.2 Wall Mounted Terminal Frames/Blocks

Many of the Commo Rooms will be fitted with wall mounted Homaco frames to support the termination of Red and Black copper backbone cabling in the facility. Wall frames will be fitted with 66 type blocks. Units shall include some form of wire management vertically.

- a. Specified Manufacturer
Homaco or Equal
Part# 50M-400W (400 Pair wall mount frame)
50M-900W (900 Pair wall mount frame)
50M-1500W (1500 Pair wall mount frame)
H66M1-50 (66 blocks)

* MSE/FM cable end terminations will require the use of Telco style frames with 66 blocks. Frame type to be determined. May be Newton product or Homaco. Anticipate their use. Reference drawings for rack quantities. All pairs to be terminated.

2.7.3 Coaxial rack mounted modular panels

48 port modular type, Flying V multi-media patch panels will be required to support the termination of horizontal coaxial cabling in the facility. Cables shall be dressed in neatly with RG-6 cables terminating to one side of the panel and RG-58 cables terminating on the other side of the panel.

- a. Specified Manufacturer
Panduit or Equal
Part# CPPLA48WBL (48 port, 2RU modular patch panel)
Part# CMFBA** (75 Ohm RG-6, F type conn./module)
Part# CMBA** (50 Ohm RG-58, BNC conn./module)

2.7.4 CABLE TRAY

Reference Section 2.6.2

2.7.5 TELEPHONE BACKBOARD

Reference Section 2.6.1

2.7.6 UNINTERRUPTIBLE POWER SUPPLY (UPS)

UPS shall be rack mounted, 2200 VA, 120 VAC - 120 VAC, continuous duty, "true on-line type", designed to provide high quality regulated conditioned uninterruptible alternating current power to LAN switches.

UPS shall consist of a single-line unit complete with rectifier/battery charger, batteries, inverter, output receptacles (4 each NEMA 5-15R and 2

each 5-20R) and all other required electrical and mechanical equipment, devices, etc.

Modes of Operation:

1. Normal - UPS shall provide conditioned AC power to the load from the normal power building power distribution system or the emergency/standby engine generator set, while simultaneously float charging batteries.
 2. Emergency - Upon degradation or failure of the normal power supply, the load shall be supplied by the UPS batteries. There shall be no interruption of power while switching from normal to the batteries or while switching from batteries back to normal power. If the batteries are exhausted before normal power is restored, the UPS shall shut down automatically.
- Recharge - Upon restoration of normal power, even if the batteries are discharged below limits the UPS shall re-start, the rectifier/charger shall awaken and gradually assume both the output and battery re-charge loads.

Input filtering shall be provided to reduce reflected input current distortion to 10% or less at full load, and to improve input power factor to minimum 90% at any load.

Batteries shall be sealed maintenance free type designed for UPS service. Batteries shall have sufficient capacity to maintain UPS full load output for a minimum of 10 minutes. The batteries shall be operated in floating mode under normal operating conditions.

2.8 MISCELLANEOUS PRODUCTS

Miscellaneous information relating to material is included in this section.

2.8.1 10% Stock Material

Include in this project is the procurement and turn over to the Facility an additional 10% of each of the products used to complete the project. These extra products will be used by the facility for unanticipated additions or changes required in the future. 10% overage of products will be stocked by the Owner. When 10% is less than 1 item provide 1 item. Round odd percentages to the nearest 5 or 10. Example - installed 47 blue cat 6 jacks on the project. Provide Owner 5 extra jacks in original packaging.

2.8.2 Category 6 Tester

Included in the project shall be the purchase of a new Fluke DSP 4300 cable tester. This tester shall be used by the Owner to confirm contractor testing and workmanship. Unit shall be in original packaging upon turn over to the Owner. All required test leads shall be included to test the copper and optical fiber cabling being installed on the project.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown on construction document drawings. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with ANSI/TIA/EIA-606. Wiring shall be installed in accordance with ANSI/TIA/EIA-568-B. Wiring, and

terminal blocks and outlets shall be marked in accordance with ANSI/TIA/EIA-606. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Fiber optic cables shall be installed either in conduit or through inner duct in cable trays to prevent microbending losses. Copper cable not in a wireway shall be suspended a minimum of 8 inches above ceiling grid by cable supports spaced no greater than 48 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered. In raised floor areas, cable shall be installed after the flooring system has been installed.

3.1.1.2 Copper and Fiber Optic Backbone Cable - Intra-building

Cable bend radius shall not be less than ten times the outside diameter of the cable during installation and once installed. Maximum tensile strength rating of the cable shall not be exceeded. Cable shall not be spliced.

3.1.1.3 Telecommunications Outlets

3.1.1.3.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link. Jacks shall be terminated using TIA 568B or A wiring configuration as determined by Owner. Color code jacks as indicated on drawings. Refer to drawings for proper outlet configurations.

3.1.1.3.2 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 150 mm (6 inches) of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.1.3.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have cable installed. Pull cords are also required in all conduit runs that cable has been installed.

3.1.1.4 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized. Use drawings to identify termination frame locations.

3.1.5 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant. Horizontal wire managers are not required between patch panels. However a Panduit WMPH2 shall be installed at the very top and very bottom of each rack. These managers will be used to transport cable from one side of the rack to the other as required.

3.1.6 Fiber Optic Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 10 percent spares. A slack loop of fiber shall be provided within each panel. Loop shall be a minimum of 10 feet in length or provided as recommended by the manufacturer whichever is greater. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.7 Equipment Racks

Open frame equipment racks shall be bolted to the floor using specified raised floor mounting brackets. Wire managers shall be bolted or screwed to racks. Racks shall be installed level and anchor to the overhead cable tray as well. Ganged racks shall be bolted together. Seismic bracing is required.

3.1.8 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.1.9 Spare Parts

The Contractor shall provide spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements except on workstation ends of voice designated cables. Pairs shall remain twisted together to within the proper distance from the termination

as specified in ANSI/TIA/EIA-568-B. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.2.3 Coaxial Cable

Home run type station cables shall be terminated at each end. Backbone cables shall be terminated with appropriate connectors or end-of-line terminators as required. Loop-type cable systems shall be terminated with appropriate drop connectors and terminators as required. Backbone cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.2.4 Fiber Optic Cable

Each fiber shall have connectors installed on both ends. The mated pair loss, without rotational optimization, shall not exceed 1.0 dB. Fiber optic connectors shall be installed per EIA ANSI/TIA/EIA-568-B.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with EIA ANSI/TIA/EIA-607 and Section 16415 ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide 10% extra material for all elements of the telecommunications installation. This includes patch panel, patch cords, faceplates, jacks, etc. Extra materials will provide FLBSC with stock necessary to facilitate immediate changes as required to the network and dictated by the exercise taking place.

3.5 ADMINISTRATION AND LABELING

3.5.1 Labeling

3.5.1.1 Labels

All labels shall be in accordance with EIA ANSI/TIA/EIA-606. Contact Cliff Hawkswood at DOIM for detailed labeling requirements. Labeling requirements are defined in section 16740 of the Fort Lewis PW Design Guide which is available on their web page or can be received via email from Cliff upon request. hawkc@lewis.army.mil

3.5.1.2 Cable

All cables will be labeled using color labels on both ends with identifiers per EIA ANSI/TIA/EIA-606 and in accordance with DOIM approved labeling scheme and methods.

3.5.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using color coded labels with identifiers per EIA ANSI/TIA/EIA-606 and in accordance with DOIM approved labeling scheme and methods.

3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made in accordance with the approved Test Plan submitted by the Contractor, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided. The Contractor shall submit Test Reports as they are completed.

3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. The test shall be completed and all errors corrected before any other tests are started.

3.6.2 Category 6 Circuits

All category 6 circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA TIA/EIA-TSB-67 standard, including the additional tests and test set accuracy requirements of EIA ANSI/TIA/EIA-568-B.2-1. Testing shall use the Basic Link Test procedure of EIA TIA/EIA-TSB-67, as supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Cables and connecting hardware which contain failed circuits shall be replaced and retested to verify the standard is met.

3.6.4 Coaxial Cable

Cable shall be tested for continuity, shorts and opens. Characteristic impedance shall be verified over the range of intended operation. Cable length shall be verified. Cable shall be sweep tested for attenuation over the range of intended operation.

3.6.5 Fiber Optic Cable

Unless stated otherwise, tests shall be performed from both ends of each circuit. Connectors shall be visually inspected for scratches, pits or chips and shall be reterminated if any of these conditions exist. Each circuit leg and complete circuit shall be tested for insertion loss at 850 and 1300 um multi-mode and 1310 and 1550 nm single-mode using a light source similar to that used for the intended communications equipment. High-resolution optical time domain reflectometer (OTDR) tests shall be performed from one end of each fiber. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80 percent of the X-axis.

-- End of Section --

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